



The herpetofauna of Coahuila, Mexico: composition, distribution, and conservation status

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Abstract.—The herpetofauna of Coahuila, Mexico, is comprised of 143 species, including 20 anurans, four caudates, 106 squamates, and 13 turtles. The number of species documented among the 10 physiographic regions recognized ranges from 38 in the Laguna de Mayrán to 91 in the Sierras y Llanuras Coahuilenses. The individual species occupy from one to 10 regions ($\bar{x} = 3.5$). The numbers of species that occupy individual regions range from 23 in the Sierras y Llanuras Coahuilenses to only one in each of three different regions. A Coefficient of Biogeographic Resemblance (CBR) matrix indicates numbers of shared species among the 10 physiographic regions ranging from 20 between Llanuras de Coahuila y Nuevo León and Gran Sierra Plegada to 45 between Serranías del Burro and Sierras y Llanuras Coahuilenses. A similarity dendrogram based on the Unweighted Pair Group Method with Arithmetic Averages (UPGMA) reveals that the Llanuras de Coahuila y Nuevo León region is most dissimilar when compared to the other nine regions in Coahuila (48.0 % similarity); all nine other regions cluster together at 57.0% and the highest similarity is 92.0% between Laguna de Mayrán and Sierra de la Paila. The distribution patterns concerning numbers of shared species reflect higher similarity between regions that share geographic contact with each other and have comparable ecological parameters. The percentage of species restricted to one or two physiographic regions is 63.6%, indicating a moderately narrow distribution for many species. The largest number of species is placed in the non-endemic category (100), followed by the country endemics (31), state endemics (nine), and non-natives (three). The principal environmental threats to the herpetofauna are urban development, industrial pollution, deforestation, road effects, mining and energy projects, natural gas fracking, wind turbines, elimination due to cultural beliefs and practices, commercial trade, and forest fires. The conservation status of the native species is assessed by using the SEMARNAT (NOM-59), IUCN, and EVS systems, of which the EVS system proved to be the most useful. The EVS rankings also were used to determine how species in the IUCN categories of Not Evaluated (NE) and Least Concern (LC) might be evaluated more informatively. Using the Relative Herpetofaunal Priority (RHP) methodology, we determined that the most significant herpetofaunas are those of the Gran Sierra Plegada and the Sierras y Llanuras Coahuilenses. Nineteen protected areas are established in Coahuila and we predict that 119 of the 143 species in the state occur in them, based on their respective physiographic distributions. Finally, a set of conclusions and recommendations for the future protection of the Coahuilan herpetofauna is presented.

Key words. Amphibians, anurans, caudates, physiographic regions, protected areas, protection recommendation, reptiles, squamates, turtles

Resumen.—La herpetofauna de Coahuila, México consiste de 143 especies, incluyendo 20 anuros, cuatro caudados, 106 escamosos, y 13 tortugas. El número de especies documentadas entre las 10 regiones fisiográficas reconocidas va de 38 en la Laguna de Mayrán, a 91 en Sierras y Llanuras Coahuilenses. Las especies individuales ocupan de una a 10 regiones ($\bar{x} = 3.5$). El mayor número de especies en una sola región va de 23 en la Sierras y Llanuras Coahuilenses a una en cada una de las tres regiones. Una matriz de coeficiente de similitud biogeográfica (CSB) indica que el número de especies compartidas entre las 10 regiones fisiográficas va de 20 entre Llanuras de Coahuila y Nuevo León y la Gran Sierra Plegada a 45 entre Serranías del Burro y Sierras y Llanuras Coahuilenses. Un dendrograma de similitud basado en el Método por Agrupamiento de Pares no Ponderado con Media Aritmética (MAPMA) revela que sobre una base jerárquica, Llanuras de Coahuila y Nuevo León es la más desigual cuando se le compara con las otras nueve regiones en Coahuila (48.0% similitud); todas las nueve regiones se agrupan en 57.0% y la mayor similitud es 92,0% entre Laguna de Mayrán y Sierra de la Paila. Los patrones de distribución con respecto al número de especies compartidas reflejan una mayor similitud entre las regiones en contacto geográfico y con parámetros ecológicos comparables. El porcentaje

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de especies restringidas a una o dos regiones fisiográficas es de 63.6%, indicando una distribución moderada para muchas especies. El mayor número de especies está ubicado en la categoría de no endémica (100), seguido de endémicas al país (31), endémicas al estado (nueve), y no nativas (tres). Las principales amenazas ambientales a la herpetofauna son el desarrollo urbano, contaminación industrial, deforestación, efectos de carreteras, actividad minera, actividad petrolera (fracking), turbinas eólicas, matanza por falta de educación y para uso medicinal, colecta y comercio, e incendios forestales. Calculamos el estatus de conservación de las especies nativas usando los sistemas de SEMARNAT (NOM-059), UICN, y el EVS, de los cuales el EVS resultó ser más útil. También usamos los rangos de EVS para determinar cómo las especies en las categorías de No Evaluada (NE) y de Preocupación Menor (PM) de la UICN podrían ser evaluadas de una forma más informativa. Asimismo, usando el método de Prioridad Herpetofaunística Relativa (PHR), determinamos que la herpetofauna más significativa es la de Gran Sierra Plegada y la de Sierras y Llanuras Coahuilenses. Diecinueve áreas protegidas han sido establecidas en Coahuila y predecimos que 119 de las 143 especies que ocurren en el estado serán encontradas en estas áreas, basado en su distribución geográfica. Finalmente, incluimos un grupo de conclusiones y recomendaciones para la futura protección de la herpetofauna de Coahuila.

Palabras claves. Anfibios, anuros, caudados, regiones fisiográficas, áreas protegidas, recomendaciones de protección, reptiles, escamosos, tortugas

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“Like it or not, and prepared or not, we are the mind and stewards of the living world. Our own ultimate future depends upon that understanding.”

E. O. WILSON (2016)

Introduction

Coahuila is the third largest state of Mexico after Chihuahua and Sonora, all of which border the United States of America. Coahuila is bounded to the north by the US state of Texas, to the west by the Mexican states of Chihuahua and Durango, to the south by Zacatecas and a small portion of San Louis Potosí, and to the east by Nuevo León. Coahuila encompasses 151,595 km² and falls in size between the US states of Illinois and Georgia (<http://cuentame.inegi.gob.mx/monografias/informacion/coah/default.aspx?tema=me&e=05>; accessed 26 August 2017). Coahuila’s population was 2,954,915 in 2015, which is 2.5% of the same-year estimate for the entire country of Mexico (119,530,753). Coahuila is one of the six least densely populated states in Mexico (the others are Chihuahua, Sonora, Campeche, Durango, and Baja California Sur), each of which has fewer than 20 inhabitants per square kilometer; the figure for Coahuila is 19.5 (<http://cuentame.inegi.gob.mx/monografias/informacion/coah/default.aspx?tema=me&e=05>; accessed 26 August 2017). The capital and largest city in Coahuila is Saltillo, located in the southeastern portion of the state.

Much of Coahuila lies within the borders of the Chihuahuan Desert (Lazcano et al. 2017), except for the northeastern portion located within the Llanuras de

Coahuila y Nuevo León region and the southeastern corner in which is found a small portion of the Gran Sierra Plegada region (Fig. 1). In Mexico, the Chihuahuan Desert also encompasses “a large portion of the state of Chihuahua..., northeastern Durango, the extreme northern part of Zacatecas, and small western portions of Nuevo León” (<https://www.worldwildlife.org/ecoregions/na1303>; accessed 24 December 2017).

The purpose of this paper, similar to that of the others in the Mexican Conservation Series (see below), is to document the composition, physiographic distribution, and conservation status of the herpetofauna of Coahuila. In general, the format of the earlier papers in this series is followed here.

Materials and Methods

Our Taxonomic Position

In this paper, we follow the same taxonomic position as explained in previous works on other portions of Mesoamerica (Johnson et al. 2015a,b; Mata-Silva et al. 2015). Johnson (2015b) can be consulted for a statement of this position, with special reference to the subspecies concept.

Updating the Herpetofaunal List

Several recent works on the herpetofauna of Coahuila are available. Lemos-Espinal and Smith (2007) created a bilingual (Spanish and English) treatment of the state herpetofauna, in which they recognized 129 species. Eight years later, Lemos-Espinal et al. (2015) compiled

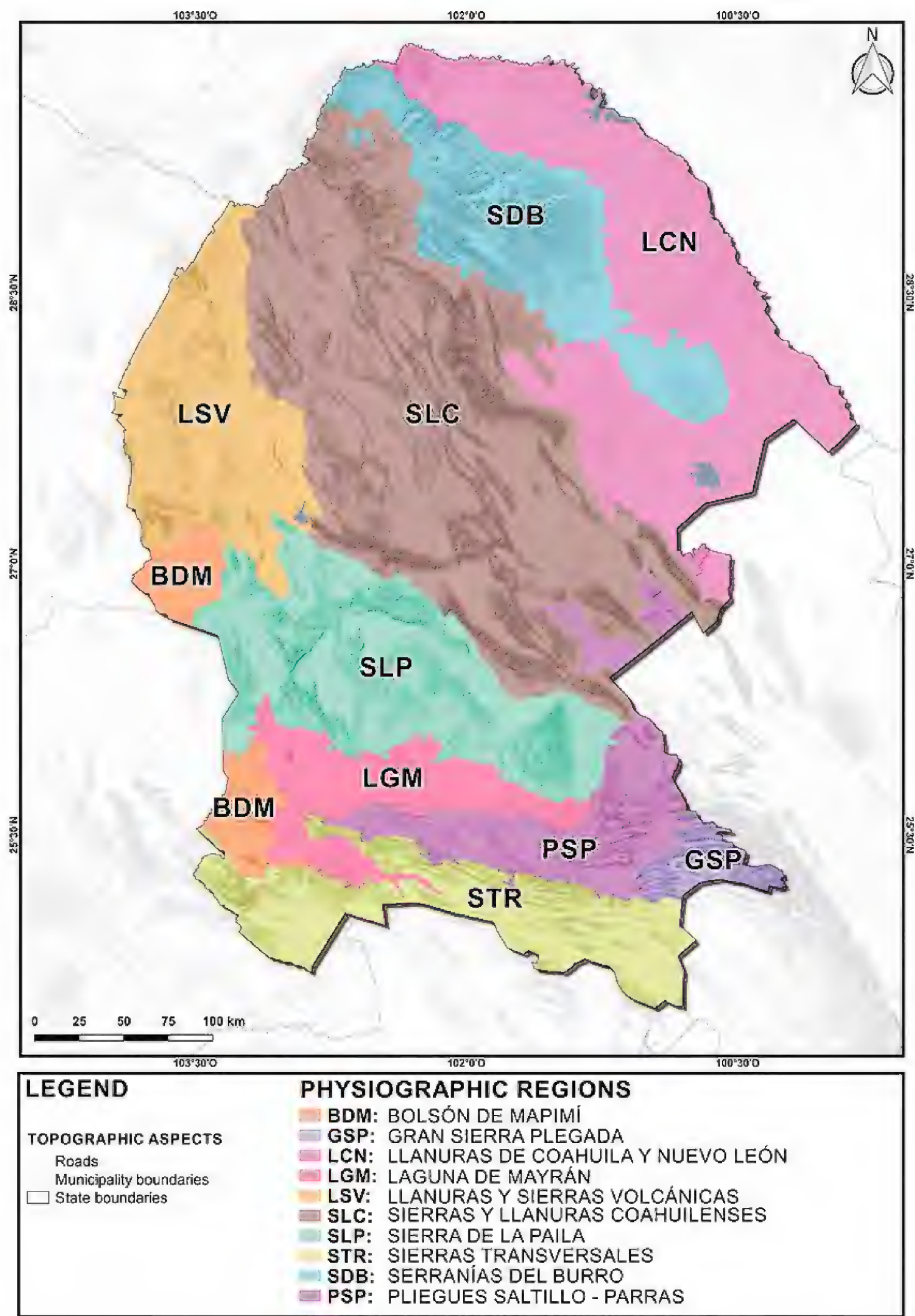


Fig. 1. Physiographic regions of Coahuila, Mexico. Abbreviations are as follows: BDM = Bolsón de Mapimi; GSP = Gran Sierra Plegada; LCN = Llanuras de Coahuila y Nuevo León; LGM = Laguna de Mayrán; LSV = Llanuras y Sierras Volcánicas; PSP = Pliegues Saltillo-Parras; SLC = Sierras y Llanuras Coahuilenses; SLP = Sierra de la Paila; STR = Sierras Transversales.

a two-volume bilingual compendium of the herpetofauna of three Mexican states (Chihuahua, Coahuila, and Sonora), in which they recorded 131 species for Coahuila. In the same year, Lemos-Espinal (2015) edited a book on the herpetofauna found in the states along the Mexico-US border, and recorded 133 species for Coahuila. Finally, Lemos-Espinal and Smith (2016) produced a checklist of the Coahuila herpetofauna, in which they again reported 133 species for the state. The name usages indicated in the Taxonomic List located at

the *Mesoamerican Herpetology* website (<http://www.mesoamericanherpetology.com>; accessed 8 March 2018) are followed here.

System for Determining Distributional Status

The system developed by Alvarado-Díaz et al. (2013) for the herpetofauna of Michoacán is employed to ascertain the distributional status of members of the herpetofauna of Coahuila. Mata-Silva et al. (2015), Johnson et al.



Fig. 2. *Bolsón de Mapimí.* Vegetation in the Bolsón de Mapimí, in the municipality of the same name in the neighboring state of Durango. Photo by Gabriel Viesca Ramos.

(2015a), Terán-Juárez et al. (2016), Woolrich-Piña et al. (2016, 2017), Nevárez-de los Reyes et al. (2016), Cruz-Sáenz et al. (2017), and González-Sánchez et al. (2017) used this system, which consists of the following four categories: SE = endemic to Coahuila; CE = endemic to Mexico; NE = not endemic to Mexico; NN = non-native in Mexico.

Systems for Determining Conservation Status

Assessment of the conservation status of the herpetofauna of Coahuila, employed the same systems (i.e., SEMARNAT, IUCN, and EVS) used by Alvarado-Díaz et al. (2013), Mata-Silva et al. (2015, 2019), Johnson et al. (2015a,b), Terán-Juárez et al. (2016), Woolrich-Piña et al. (2016, 2017), Nevárez-de los Reyes et al. (2016), Cruz-Sáenz et al. (2017), González-Sánchez et al. (2017), and DeSantis et al. (2018). Detailed descriptions of these three systems appear in earlier papers in this series.

The Mexican Conservation Series

The Mexican Conservation Series (MCS) was initiated in 2013, with a study of the herpetofauna of Michoacán (Alvarado-Díaz et al. 2013), as a part of a set of five papers designated as the Special Mexico Issue published in *Amphibian & Reptile Conservation*. The basic format of the entries in the MCS was established in that paper, i.e., to examine the composition, physiographic distribution, and conservation status of the herpetofauna of a given Mexican state or group of states. Two years later, the MCS was continued with papers on the herpetofauna of Oaxaca (Mata-Silva et al. 2015) and Chiapas (Johnson

et al. 2015a). In the ensuing year, three entries in the MCS appeared, those on Tamaulipas (Terán-Juárez et al. 2016), Nayarit (Woolrich-Piña et al. 2016), and Nuevo León (Nevárez-de los Reyes et al. 2016). Finally, three entries on Jalisco (Cruz-Sáenz et al. 2017), the Mexican Yucatan Peninsula (González-Sánchez et al. 2017), and Puebla (Woolrich-Piña et al. 2017) appeared. Thus, this paper on the herpetofauna of Coahuila is the 10th entry in this series.

Physiography and Climate

Physiographic Regions

The classification system of physiographic regions (= subprovinces) developed by INEGI in 2004 was used to analyze the distribution of the herpetofauna of Coahuila. This system consists of 10 regions (Fig. 1), which are briefly described below (see INEGI, <http://www.inegi.org.mx/est/contenidos/proyectos/ce/ce2004/presentacion.aspx>).

Bolsón de Mapimí (BDM). This region, which encompasses 4,715 km² (3.1% of the state area), is entirely confined within Mexican territory and runs along the Sierra Madre Occidental, eventually expanding to the east in the Mapimí zone. Plains and bajadas dominate the landscape, although small sierras and lomeríos facing north-south are also found there. The sierras and lomeríos located to the north are composed predominantly of volcanic rocks and are found associated with faults on their flanks; to the south limestone is the most abundant rock. The northern portion of the region is transected by



Fig. 3. *Gran Sierra Plegada*. Vegetation in the vicinity of Monterreal in the municipality of Arteaga. Photo by Eli García-Padilla.

the Río Florido and its effluents, and tributaries of the Río Conchos; the southern portion is crossed by the Río Nazas. Superficial water sources, however, are scarce. The Bolsón de Mapimí is a flat region at elevations around 1,200 m, located between Sierra del Diablo, Sierra Mojada, and irrigation district no. 17. The latter region, also known as the Comarca Lagunera or La Laguna, used to be inundated every summer by the waters of the Río Nazas until the construction of the Reservoir Francisco Zarco in the state of Durango. The arid plains of Mapimí are interrupted by low geomorphological features such as sand dunes in the northeastern portion. Deep soils of alluvial or lacustrine origin are well-represented in the plains. Most of the original vegetation around Torreón, Matamoros, and San Pedro de las Colonias has been replaced by agricultural fields. A section of the region in Laguna del Rey, however, contains microphyll desert scrub; and a similar habitat is found in the ridges of Mojada and Montaña del Rey. The middle of this region contains sand dunes, and the vegetation consists primarily of Gobernadora/Creosote Bush (*Larrea tridentata*) and huizaches (*Vachellia* [*Acacia*] spp.), providing minimum surface cover. The landscapes at La Laguna and El Guaje are represented by halophytic vegetation, and of less importance are small areas of grassland and scrubland where the main plant species is *L. tridentata*.

Llanuras y Sierras Volcánicas (LSV). This region covers approximately 14,000 km² (9.2%) of the state of Coahuila, with elevations ranging between 600 m and 1,200 m. The largest area of this territory is represented by plains or bajadas; these flat surfaces are more prominent and less

disrupted at Llano de los Ranchos, south of the mountain ranges that rise along the Río Bravo/Grande and at Bolsón de los Lipanes to the north of Sierra Mojada. This region includes small sierras of volcanic rock, such as Sierra el Mulato, Ocotillo, and Hechicero, located to the southeast of Ojinaga and the banks of the Río Bravo. Small mountains of limestone arise at the southern edge border with Bolsón de Mapimí, as in La Mojada and El Diablo. Some streams originating in this region feed the Río Bravo, and some accumulate water for short periods of time, but the climate regime is that of a desert.

The landscape in this region is dominated by shrubs, which are generally shorter than two m. Microphyll desert scrub is found with some variations in its components, with plains and slopes mostly vegetated by Gobernadora (*L. tridentata*), Viscid Acacia/Huizache (*Vachellia vernicosa*), Ocotillo (*Fouquieria splendens*), and mesquite (*Prosopis* spp.); there are also other vegetation elements, such as gatuño/Mimosa (*Mimosa* spp.), Purple Prickly-pear (*Opuntia macrocentra*), and a minor proportion of huizaches reaching heights of less than 1.5 m. The components of the lower strata are Cenizo (*Leucophyllum frutescens*), Mariola (*Parthenium incanum*), Hierba del Burro/Zinnia (*Zinnia acerosa*), and Plumed Crinklemat (*Tiquilia greggii*). Arborescent yuccas (*Yucca* spp.) and Viscid Acacia (*V. vernicosa*) also are found, reaching heights of more than four m. This community is widely distributed in the region, in all the bajadas that feed the lagoon El Guaje and the western plains.

Laguna de Mayrán (LDM). Laguna de Mayrán covers 7,804 km² (5.1%) of the state, and is mostly represented



No. 1. *Anaxyrus speciosus* (Girard, 1854). The Texas Toad is distributed from “southeastern New Mexico and western Oklahoma (USA) south throughout central and West Texas to central Tamaulipas, northern Nuevo León, northern and eastern Coahuila, and northeastern Chihuahua” in Mexico (Frost 2018). This individual came from Allende, in the municipality of Allende. Wilson et al. (2013b) calculated its EVS as 12, placing it in the upper portion of the medium vulnerability category. Its conservation status has been considered as Least Concern by IUCN, but this species is not listed by SEMARNAT. *Photo by Michael S. Price.*



No. 2. *Craugastor augusti* (Dugès, 1879). The Common Barking Frog occurs from “Arizona to Texas in the United States, and in Mexico from Sonora to Oaxaca, and from Chihuahua, Coahuila, Nuevo León, and Tamaulipas to Puebla” (Lemos-Espinal and Dixon 2013: 42). This individual was found at Cuatrociénegas in the municipality of Cuatrociénegas de Carranza. Wilson et al. (2013b) ascertained its EVS as 8, placing it in the upper portion of the low vulnerability category. Its conservation status has been evaluated as Least Concern by IUCN; this species is not listed by SEMARNAT. *Photo by Michael S. Price.*



No. 3. *Lithobates berlandieri* (Baird, 1859). The Rio Grande Leopard Frog ranges from “central and western Texas and southern New Mexico (USA) through eastern Chihuahua to central Veracruz and Hidalgo, Mexico; introduced into the lower Colorado River and lower Gila River drainages of Sonora and Baja California del Norte, Mexico, and California and Arizona, USA.” (Frost 2018). This individual was found at El Oso, in the municipality of Cuatrociénegas de Carranza. Wilson et al. (2013b) calculated its EVS as 7, placing it at the middle portion of the low vulnerability category. Its conservation status has been considered as Least Concern by IUCN, and as a species of special protection (Pr) by SEMARNAT. *Photo by Michael S. Price.*



No. 4. *Barisia ciliaris* (Smith, 1942). The Sierra Alligator Lizard is a Mexican endemic distributed “along the Sierra Madre Oriental from Nuevo León and southeastern Coahuila southward to at least Guanajuato, and northward along the Sierra Madre Occidental to extreme southern Chihuahua” (Lemos-Espinal and Dixon 2013: 97). Pictured here is an individual encountered near Monterreal, in the municipality of Arteaga. Wilson et al. (2013a) determined its EVS to be 15, placing it in the lower portion of the high vulnerability category. Its conservation status has not been assessed by IUCN, and this species is not listed by SEMARNAT. *Photo by Elí García-Padilla.*

by grassland and some hills found in the municipalities of Francisco I. Madero, General Cepeda, Parras, San Pedro, and Viesca. This region includes endorheic terminal basins of the Nazas and Aguanaval rivers. These rivers emerge in the Sierra Madre Occidental province, and flow northward through the province of Mesa del Centro to the Mayrán lagoon. The region is mostly represented by two bodies of water, Laguna de Mayrán, formerly fed by the Nazas and Viesca rivers, and Laguna de Viesca, a smaller water body fed by the Aguanaval River. Both lagoons are located at an elevation of ca. 1,400 m, with a west-east orientation, and are separated from each other by a phalanx of the Sierra Madre Oriental. Until recently, these deposits used to store a significant amount of water for most of the year, but currently their nearly level surfaces have turned into desert plains, with saline areas at the center of the Mayrán lagoon and almost the entire Viesca lagoon. Their disappearance as lakes and their final passage to a desert regime are the result of reservoirs and canal systems built on the Nazas and Aguanaval rivers for irrigation of the Laguna district; activities that, on the other hand, have significantly increased productivity in other areas.

Halophytic vegetation is the dominant element of the landscape, as the soils contain high concentrations of salts. In fact, roughly from San Pedro de las Colonias to the boundaries of the Mayrán lagoon and throughout the region, there is no other component than halophytic vegetation. The area around Mesa Albardienta is completely devoid of vegetation due to hypersaline conditions in the soil. Halophytic vegetation in this region is represented by Saladillo/Salt Bushes (*Atriplex* spp.), Seepweeds (*Suaeda* spp.), and Dropseed (*Sporobolus* spp). Besides these types of vegetation, there are small areas with microphyll desert scrub and rosette scrub in the Sierrita San Lorenzo.

Sierras y Llanuras Coahuilenses (SLC). This region covers 43,937 km² (29.0%) of the state. It includes the municipalities of Abasolo, Frontera, Lamadrid, Nadadores, Sacramento, and San Buenaventura, as well as parts of Acuña, Candela, Castaños, Cuatrociénegas, Escobedo, Monclova, Múzquiz, Ocampo, Progreso, and Ramos Arizpe, and very small portions of San Juan de Sabinas and Zaragoza. It consists of folded limestone mountains ranges, oriented northwest to southeast, mostly with steep small folds. Most of the mountains lie between elevations of 1,000 to 2,000 m, although peaks with elevations over 2,000 m can be found only in Sierra El Carmen and Sierra de San Antonio. The region has mostly internal drainage, so its runoff contributions to the Río Bravo are minimal.

Vegetation types present in the region are submontane scrub, chaparral, microphyll desert scrub, and rosette scrub. The chaparral is generally a dense shrub community, which is distributed in the transition zone between the arid scrubland and forests. In this region, it

represents an intermediate layer between the submontane shrubs and forest, and is also frequently found mixed as chaparral and desert scrub. It is composed of shrubby oaks (*Quercus* spp.) and shrub species in the genera *Cercocarpus* and *Vauquelinia*, among others. Other shrub components such as sotols (*Dasyllirion* spp.) and yuccas (*Yucca* spp.) are also present.

Serranías del Burro (SDB). This region encompasses 13,234 km² (8.7%) of the state, and includes parts of the municipalities of Acuña, Guerrero, Múzquiz, Sabinas, Villa Unión, and Zaragoza, as well as very small portions of Juárez, Morelos, and San Juan de Sabinas. The Serranías del Burro has a normal fault on its northwestern flank. It is rugged in its central part, which includes a radial system of narrow valleys, but lies much more towards the east and southeast, where the sierra becomes narrow and descends into the hilly zone of Peyotes. A series of igneous intrusions crosses the Serranías del Burro from east to west near Villa Acuña and Cerro El Colorado, with the latter representing the highest peak of the mountain range, with an elevation of 1,400 m. The region has few major streams, although it has slopes toward the Río Bravo. Soils in the topoform systems (sierras) constituting this region are mainly represented by shallow lithosols, while xerosols, phaeozems, and regosols cover the small systems of hills (lomeríos). Soils on slopes (bajadas) have colluvial or colluvial-alluvial sources, and the edaphic landscapes in the intermontane valleys of the Serranías del Burro are very similar to those in the other regions mentioned above. The vegetation types found in this region are typical of the arid zones of Mexico. The hilly zones (lomeríos) that border the mountains of Colorado, del Burro, and La Babia are covered with rosette scrub. Among the main components of this vegetation are Lechuguilla (*Agave lechuguilla*), Texas Sotol (*Dasyllirion texanum*), and short yuccas (*Yucca* spp.). Submontane shrubs on the Serranías del Burro also ascend the eastern slopes of the range, with the most distinctive components being Cenizo/Purple Sage (*Leucophyllum frutescens*), Tenazas (*Havardia pallens*), Hoja Ancha/Tarbrush (*Flourensia laurifolia*), and Coyotillo/Buckthorn (*Karwinskia* sp.). Another vegetation formation of great importance in the region is chaparral, which grows below the oak forest on the Sierras del Burro, del Carmen, and La Babia; this vegetation also grows on the small hills located immediately to the north of these mountain ranges. There is also a large number of pine forests in this region, numerically dominated by Pino Piñonero (*Pinus cembroides*). Additionally, there are large extensions of grassland in the intermontane valleys immediately below the chaparral.

Finally, in the lower portion of the sierras, adjacent to the Great Plains of North America, there is Tamaulipecan thorn scrub. This vegetation is located on the hills to the south of the region bordering the rosette scrub

found on the hills of Peyotes. The main components of this vegetation formation are Palo Verde (*Cercidium texanum*), Chaparro Amargoso/Indian Paintbrush (*Castela texana*), Cenizo (*Leucophyllum frutescens*), and mesquite trees (*Prosopis* spp.).

Sierra de la Paila (SLP). This region includes sierras, large bolsons with internal drainage, and bajadas. It covers ca. 19,230 km² (12.7%) of the state. Valle Buenavista bolson is located in the western portion, bordered to the west by Sierra de Tlahualilo and to the east by the highlands of Albardienta, which reach an elevation of 1,800 m. Sierra de La Paila is located to the east, and the bolsons El Sobaco, El Hundido, San Marcos, and Los Pinos are located to the north, with the first three at less than 1,000 m elevation. As in the other regions, the soils and biodiversity in the Sierra de La Paila is influenced by climate, which is semiarid at high elevations and very arid in the grasslands and bolsons. Although topographically rugged, the sierras have relatively small portions covered with soils. There are, however, deep soils of primarily alluvial origin in the lower sections of the bolsons that have high concentrations of salts. Also, there are sandy soils of eolic origin that form dunes.

The vegetation communities in this region are mostly the same as those in Sierras Transversales and Pliegues Saltillo-Parras. Microphyllous and rosette scrub is closely associated with the terrain, and dry and semidry climatic conditions are present in the bajadas and valleys. Rosette scrub is widely distributed in all sierras such as La Fragua, La Mesa Albardienta, and La Paila. Chaparral is a community of shrubs primarily represented by oaks (*Quercus* spp.), Chapote/Texas Persimmon (*Diospyros texana*), and some elements of rosette scrub, like yuccas, Sotol, and Lechuguilla. Submontane shrub is a community composed of shrubs, primarily Chapote (*D. texana*), Tenazas (*H. pallens*), Guajillo (*Acacia berlandieri*), and Chaparro Prieto (*Acacia amentacea*). These shrubs are also found in La Paila and La Fragua at the same elevations as chaparral.

Pliegues Saltillo–Parras (PSP). This region covers 9,195 km² (6.1%) of the state of Coahuila. The landscape is represented by a set of valleys extending from east to west, situated at an elevation of approximately 1,600 m and bordered to the north and south by eroded flanks and valleys. The region also includes the Sierra de Parras, on which peaks can reach more than 3,000 m, and includes a succession of truncated large flanks toward the south. This region in Coahuila includes parts of the municipalities of Parras, Cepeda, Saltillo, Arteaga, Ramos Arizpe, Castaños, Candela, and Monclova.

Microphyll desert scrub and rosette scrub are the dominant vegetation types in this area. Rosette scrub is distributed on mountain ranges, slopes, and hills, especially in shallow soils, and alternating with microphyll scrub in flatter areas, in deep and alluvial soils.

To the north of San Martín de las Varas, rosette scrub contains some representatives of *Pinus cembroides*, but they do not modify the physiognomy of this vegetation community. Pine forests are also found in the southern part of the region, on the bajadas of the Sierra El Jabalí, where their density increases with elevation. Between the scrub and forest, there are two types of natural and introduced grassland areas. The first area is located south of General Cepeda, and to the south of Saltillo on the hills next to Estación Agua Nueva, and contains grasses of the genera *Bouteloua* and *Sporobolus*. Introduced grasslands are found to the east of Saltillo, through a substantial geographic extension of grasses belonging to the genera *Bouteloua* and *Aristida*.

Sierras Transversales (STR). This region extends throughout the southern section of the state, in the municipalities of Cuatro Ciénegas, Ocampo, and Sierra Mojada, encompassing a surface area of 14,077 km² (9.3% of the state area). Over half of this region consists of sierras with shallow light-colored soils. The main vegetation is represented by rosette scrub and microphyll desert scrubland. Rosette scrub vegetation is distributed on all the mountains, slopes, and small hills located at elevations between 2,000 and 2,400 m, with large portions of this vegetation located on the sierras El Número, Candelaria, Parras, and other smaller sierras. The main components of this vegetation are Huizache (*Acacia farnesiana*), Chapotes (*D. texana*), Texas Sotol (*D. texanum*), Lechuguilla (*A. lechuguilla*), and Gatuño (*Acacia roemeriana*). In the lower parts of the sierras Playa Madero and del Laurel, the same type of vegetation is also found, where the numerically dominant *Yucca thompsoniana* gives the appearance of an Izotal (Yucca tree forest), in addition to Sotol, Lechuguilla, Chaparro Prieto (*Acacia rigidula*), and Fresno (*Fraxinus greggii*), among others. This association also is present on the bajadas of the sierras.

The abundance of microphyll shrubs is noteworthy on flat areas, especially in the southeastern part of the state, with thorny elements present, such as mesquites (*Prosopis* spp.) and huizaches (*Acacia* spp.), as well as Gobernadora (*L. tridentata*) and Hojasén (*Flourensia cernua*). Additionally, relatively small areas of grassland are found on the sierras of Gómez Farías and Jabalí, with species of the genera *Bouteloua*, *Muhlenbergia*, *Andropogon*, and *Aristida*. The southeastern section of the state also has flat areas with halophytic vegetation on saline soils, with species of saladillo (*Suaeda* spp.) and saltbushes (*Atriplex* spp.). On the other hand, chaparral, pine-oak forest, pine forest, and small areas with submontane scrub are found in the less arid sierras, such as the Sierras de Jimulco, Parras, and Jabalí. Among components of the chaparral are small oaks (*Quercus* spp.) and Pino Piñonero (*P. cembroides*).

Gran Sierra Plegada (GSP). This region covers 2,178 km² (1.4%) of the state. It includes a major portion of the

The herpetofauna of Coahuila, Mexico

Table 1. Monthly minimum, mean (in parentheses), maximum, and annual temperature data (in °C) for the physiographic regions of Coahuila, Mexico. The locality and elevation for each region are: Bolsón de Mapimí—Laboratorio del Desierto, Tlahualilo, Durango (1,160 m); Llanuras y Sierras Volcánicas—Sierra Mojada (1,256 m); Laguna de Mayrán—Viesca (1,100 m); Sierras y Llanuras Coahuilenses—San Francisco Nadadores (500 m); Serranía del Burro—Agua Nueva (370 m); Sierra La Paila—Hipólito (1,150 m); Pliegues Saltillo-Parras—General Cepeda (1,400 m); Sierras Transversales—La Ventura (1,867 m); Gran Sierra Plegada—San Antonio de las Alazanas (2,300 m); and Llanuras de Coahuila y Nuevo León—Presa Venustiano Carranza (272 m). Data from: <http://www.smn1.conagua.gob.mx/climatologia/normales/estacion/EstacionesClimatologicas.kmz>; accessed 11 November 2017.

Physiographic Region	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Set	Oct	Nov	Dec	Annual
Bolsón de Mapimí	3.0	5.0	8.2	12.4	16.5	19.1	19.2	18.6	16.7	12.7	7.3	3.3	11.8
	(11.7)	(14.0)	(17.4)	(21.5)	(25.3)	(27.2)	(26.5)	(25.8)	(23.8)	(20.6)	(15.8)	(12.0)	(20.1)
	20.3	23.0	26.7	30.6	34.1	35.3	33.9	33.0	31.0	28.5	24.2	20.6	28.4
Llanuras y Sierras Volcánicas	4.3	5.5	8.2	12.0	15.0	16.7	16.4	16.0	14.1	11.0	7.0	4.9	10.9
	(10.6)	(12.2)	(15.6)	(19.5)	(22.6)	(24.3)	(23.5)	(22.9)	(20.8)	(17.9)	(14.1)	(11.1)	(17.9)
	16.8	18.9	23.0	27.0	30.3	31.8	30.5	29.7	27.5	24.9	21.1	17.4	24.9
Laguna de Mayrán	4.0	6.2	9.0	13.0	16.7	19.5	20.2	19.5	18.0	13.4	7.7	4.6	12.7
	(14.0)	(16.4)	(19.6)	(23.3)	(26.7)	(28.3)	(28.1)	(27.6)	(26.0)	(22.4)	(17.8)	(14.4)	(22.1)
	24.0	26.7	30.3	33.6	36.6	37.1	36.0	35.7	33.9	31.5	27.8	24.2	31.5
Sierras y Llanuras Coahuilenses	2.8	4.7	7.5	11.5	16.3	19.2	19.2	20.1	17.0	12.5	7.3	4.1	11.9
	(11.0)	(14.0)	(17.4)	(21.5)	(25.7)	(28.0)	(27.8)	(28.3)	(24.8)	(20.7)	(15.8)	(12.1)	(20.6)
	19.3	23.3	27.2	31.6	35.2	36.7	36.3	36.5	32.5	28.8	24.3	20.2	29.3
Serranía del Burro	4.6	5.0	7.5	12.3	15.7	18.4	18.8	18.9	16.3	12.1	7.7	4.4	11.8
	(11.7)	(12.7)	(15.8)	(20.7)	(23.8)	(25.8)	(25.8)	(25.1)	(22.8)	(18.6)	(14.5)	(10.6)	(19.0)
	18.9	20.5	24.0	29.2	31.9	33.3	32.8	31.3	29.2	25.1	21.2	16.7	26.2
Sierra La Paila	9.6	10.7	12.8	14.5	17.6	19.5	19.5	19.4	17.6	15.9	13.1	11.1	15.1
	(15.0)	(16.0)	(17.9)	(20.2)	(23.0)	(25.1)	(25.2)	(24.8)	(22.6)	(21.0)	(18.4)	(16.1)	(20.4)
	20.3	21.3	23.1	25.9	28.3	30.8	30.9	30.2	27.6	26.1	23.6	21.1	25.8
Pliegues Saltillo-Parras	5.3	6.5	9.4	12.9	15.8	17.5	17.4	16.9	15.0	12.2	8.4	6.2	12.0
	(12.8)	(14.4)	(17.9)	(21.2)	(24.0)	(25.0)	(24.6)	(24.0)	(21.8)	(19.5)	(15.9)	(13.5)	(19.6)
	20.2	22.3	26.3	29.5	32.1	32.5	31.8	31.0	28.6	26.7	23.4	20.8	27.1
Sierras Transversales	1.9	3.1	5.3	7.5	10.9	12.3	13.3	12.6	12.2	8.8	5.6	2.1	8.0
	(11.7)	(13.1)	(16.0)	(18.5)	(21.6)	(22.5)	(22.3)	(21.7)	(21.5)	(19.4)	(15.5)	(12.0)	(18.0)
	21.5	23.1	26.8	29.4	32.3	32.6	31.3	30.8	30.8	29.9	25.5	21.9	28.0
Gran Sierra Plegada	4.2	5.0	6.2	7.8	9.0	9.5	9.6	9.1	8.6	7.2	5.6	4.6	7.2
	(12.2)	(13.2)	(14.6)	(16.4)	(17.5)	(17.5)	(17.3)	(16.9)	(16.6)	(15.6)	(14.2)	(12.7)	(15.4)
	20.2	21.3	22.9	25.1	25.9	25.5	24.9	24.4	24.6	23.7	22.9	20.7	23.5
Llanuras de Coahuila y Nuevo León	4.9	7.0	10.7	15.1	19.0	21.7	22.6	22.5	20.3	15.7	9.8	5.6	14.6
	(11.9)	(14.5)	(18.5)	(22.8)	(26.0)	(28.7)	(29.5)	(29.3)	(26.7)	(22.3)	(16.8)	(12.8)	(21.7)
	18.9	22.0	26.2	30.5	33.1	35.7	36.5	36.1	33.1	28.9	23.8	19.9	28.7

municipality of Arteaga (95%) and a very small fraction of Saltillo. This region begins east of Saltillo, Coahuila, but also includes sections in Nuevo León, Tamaulipas, and San Luis Potosí, and is dominated by folded layers of limestone. A great reverse geological fault lies on the eastern edges of the Gran Sierra Plegada, while smaller ones extend relatively parallel to it and its structural axes. The elevational range in the region is between 2,000 and 3,750 m.

The topography is predominantly mountainous, but also contains plateaus and valleys. This region is located somewhat parallel to the Gulf of Mexico and represents an orographic barrier that favors the deposition of moisture on the eastern slopes, which prevents the westward movement of moist winds. Heavy rainfall has led to the dissolution of limestone rocks in the area, resulting in a karstic environment. These processes have led to the formation of vast cavern systems and springs at the foot of the mountains. A broad elevational gradient is present in this area. The soils are dominated by lithosols, which are associated with rendzinas and calcaric regosols.

Calcic and haplic xerosols are also found within the region.

In general, two fundamental forms of plant landscapes are present in the region: forests and scrublands. Pines dominate the forested area, and desert rosette scrub, piedmont scrub, and chaparral dominate the rest of the region. Other types of vegetation in the Gran Sierra Plegada occur as small patches of grassland, halophytic vegetation, or alpine prairie, but they have minimal influence in shaping the overall landscape.

Llanuras de Coahuila y Nuevo León (LCN). This region encompasses 25,666 km² (16.9% of the state area), including the municipalities of Hidalgo, Nava, Piedras Negras, and Jiménez, and parts of Guerrero, Villa Unión, Morelos, Allende, Progreso, Escobedo, Sabinas, San Juan de Sabinas, Nueva Rosita, Múzquiz, Zaragoza, and Acuña. The region is characterized by the presence of plains interrupted with scattered low hills that are composed of conglomerates, at elevations ranging from



Fig. 4. *Llanuras de Coahuila y Nuevo Leon*. Tamaulipas thorn scrub in the municipality of Allende. Photo by Manuel Nevárez de los Reyes.



Fig. 5. *Laguna de Mayrán*. Vegetation on Cerro de la Virgen, in the municipality of Parras. Photo by José Flores Ventura.



Fig. 6. *Llanuras y Sierras Volcánicas*. Vegetation near Hércules, in the municipality of Sierra Mojada. Photo by Daniel Solorio Estrada.



Fig. 7. *Pliegues Saltillo-Parras*. Vegetation near Parras de la Fuente, in the municipality of Parras. Photo by Manuel Nevárez de los Reyes.

75 to about 500 m. One of the most extensive plains extends from Anahuac, Nuevo León, to Nueva Rosita, Coahuila, at an average elevation of 500 m.

Tamaulipan thornscrub and mesquites (*Prosopis* spp.) are the most characteristic vegetation types in this region. Tamaulipan thornscrub is distributed at elevations from 80 to 340 m, with a physiognomy of thornscrub in areas of low relief and of semi-thorn scrubland on the lower sections of areas with higher relief. Large patches of Cenizo (*L. frutescens*) are present in some areas, indicative of a high degree of disturbance to the native scrub vegetation, as this species numerically dominates the sympatric native species that are found in low frequency and are small in size. Mesquites dominate at elevations from 75 to 400 m. Piedmont scrub or Tamaulipan thornscrub predominate in some middle sections, and a prevalence of halophytic elements is present in the lower areas. Some deciduous thornscrub and deciduous hardwood forests are found in the region as well, and oak and pine-oak forests occur at higher elevations. Halophytic vegetation is found within small areas of the plains and valleys, where high salt concentrations are present in the soils. Natural grassland

occurs in some areas of the plains at elevations from 135 to 290 m. The introduced grasses on the plains and valleys are composed primarily of Buffelgrass (*Pennisetum ciliare*), which is distributed at elevations from 190 to 270 m and covers small hilly areas and alluvial plains.

Climate

Temperature. The minimum, mean, and maximum temperatures for one locality in each of the 10 physiographic regions in Coahuila are shown in Table 1. The elevations for these 10 regions range from 272 m in the Llanuras de Coahuila y Nuevo León to 2,300 m in the Gran Sierra Plegada.

The mean annual temperature (MAT) of these regions ranges from a low of 15.4 °C, in the Gran Sierra Plegada at 2,300 m in the southeastern portion of the state, to a high of 22.1 °C, in the Laguna de Mayrán at 1,100 m in the southern portion of the state. The MAT of these regions in Coahuila are unusual in that they do not gradually decrease with increasing elevation. The MAT lie below 20 °C in four additional regions, including the Llanuras y Sierras

Table 2. Monthly and annual precipitation data (in mm) for the physiographic regions of Coahuila, Mexico. The locality and elevation for each region are: Bolsón de Mapimí—Laboratorio del Desierto, Tlahualilo, Durango (1,160 m); Llanuras y Sierras Volcánicas—Sierra Mojada (1,256 m); Laguna de Mayrán—Viesca (1,100 m); Sierras y Llanuras Coahuilenses—San Francisco Nadadores (500 m); Serranía del Burro—Agua Nueva (370 m); Sierra La Paila—Hipólito (1,150 m); Pliegues Saltillo-Parras—General Cepeda (1,400 m); Sierras Transversales—La Ventura (1,867 m); Gran Sierra Plegada—San Antonio de las Alazanas (2,300 m); Sierras y Llanuras Occidentales—Carbonera, Galeana, Nuevo León (2,035 m); and Llanuras de Coahuila y Nuevo León—Presa Venustiano Carranza (272 m). The shaded area indicates the months of the rainy season. Data from: <http://www.smn1.conagua.gob.mx/climatologia/normales/estacion/EstacionesClimatologicas.kmz>; accessed 11 November 2017.

Physiographic Region	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Annual
Bolsón de Mapimí	9.5	4.0	4.2	8.9	15.2	36.2	46.6	54.8	42.4	20.8	9.1	6.9	258.6
Llanuras y Sierras Volcánicas	14.7	6.5	4.8	9.4	23.8	50.0	66.1	68.9	63.5	24.7	11.8	12.1	356.3
Laguna de Mayrán	11.4	3.0	2.5	4.1	7.1	19.3	24.9	27.1	28.5	13.4	8.1	10.5	159.9
Sierras y Llanuras Coahuilenses	10.4	6.4	7.3	13.9	35.2	38.1	49.6	36.5	58.1	28.3	10.1	14.9	308.8
Serranías del Burro	8.1	3.5	2.2	2.3	4.1	11.8	11.1	21.6	17.0	9.2	2.0	3.8	96.7
Sierra La Paila	9.0	9.1	5.8	8.2	16.8	18.0	29.1	22.3	17.7	12.7	6.8	8.6	164.1
Pliegues Saltillo-Parras	10.6	10.0	6.2	11.2	22.1	47.1	62.0	68.4	57.4	25.2	10.5	11.9	342.6
Sierras Transversales	14.8	12.8	9.3	22.8	37.4	55.9	41.8	46.9	46.9	38.7	10.5	9.1	346.9
Gran Sierra Plegada	17.5	12.4	8.4	19.7	32.8	41.2	66.3	63.2	54.1	29.8	14.7	15.3	375.4
Llanuras de Coahuila y Nuevo León	15.1	20.1	14.7	25.8	62.3	39.7	28.0	44.7	67.8	38.1	15.2	12.8	384.3

Volcánicas at 1,256 m (17.9 °C), the Serranías del Burro at 370 m (19.0 °C), the Pliegues Saltillo-Parras at 1,400 m (19.6 °C), and the Sierra Transversales at 1,867 m (18.0°C). In contrast, the MAT in the remaining five regions lie above 20 °C, including the Bolsón de Mapimí at 1,160 m (20.1 °C), the Laguna de Mayrán at 1,100 m (22.1°C), the Sierra de Paila at 1,150 m (20.4 °C), the Sierras y Llanuras Coahuilenses at 500 m (20.6 °C), and the Llanuras de Coahuila y Nuevo León at 272 m (21.7 °C).

The minimum annual temperature ranges from 7.2 °C in the Gran Sierra Plegada to 15.1 °C in the Sierra La Paila (Table 1). The maximum annual temperature varies from 23.5 °C in the Gran Sierra Plegada to 31.5 °C in the Laguna de Mayrán. The minimum annual temperature is 10.7–20.0 °C lower than the maximum annual temperature among the 10 physiographic regions of the state (Table 1). Mean monthly temperatures peak at some point from May to August, usually June, and reach a low point sometime during December or January, usually January (Table 1).

Precipitation. As expected, precipitation in Coahuila is generally highest during the rainy season from June to October, and lowest from November to May, during the dry season. The data in Table 2 indicate that 56.8–77.6% (\bar{x} = 69.4%) of the rainfall occurs during the rainy season.

Table 3. Composition of the native and non-native herpetofauna of Coahuila, Mexico.

Orders	Families	Genera	Species
Anura	7	13	20
Caudata	2	3	4
Subtotals	9	16	24
Squamata	15	44	106
Testudines	4	6	13
Subtotals	19	50	119
Totals	28	66	143

The month with the greatest amount of precipitation, depending on the location, is June, July, August, or September, usually August (Table 2). The month with the least amount of precipitation, again depending on the location, is December, February, or March, usually March (Table 2). The annual precipitation ranges from 96.9 mm in the Serranías del Burro to 384.3 mm in the Llanuras de Coahuila y Nuevo León.

Composition of the Herpetofauna

Families

The herpetofaunal species of Coahuila are placed in 28 families, including seven for anurans, two for salamanders, 15 for squamates (one of which contains only a single non-native species), and four for turtles (Table 3). The seven anuran families comprise 63.6% of the 11 families with representatives in Mexico. The two salamander families constitute 50.0% of the four families represented in the country. The fifteen squamate families make up 48.4% of the 31 Mexican families containing native species. Finally, the four Coahuilan turtle families encompass 40.0% of the 10 families in Mexico. The total of 28 families includes 47.5% of the 59 herpetofaunal families that are represented in this country (Johnson et al. 2017). There are no caecilian or crocodylian families with representatives in Coahuila.

Genera

Sixty-six herpetofaunal genera are represented in Coahuila, including 13 for anurans, three for salamanders, 44 for squamates, and six for turtles (Table 3). The 13 anuran genera constitute 35.1% of the 37 with representatives in Mexico. The three salamander genera make up 15.8% of the 19 found in Mexico. Of the



No. 5. *Gerrhonotus infernalis* Baird, 1859. The Texas Alligator Lizard ranges “from central Texas westward to the area of Big Bend, in the United States, and in Mexico east of the Sierra Madre Oriental to southern San Luis Potosí and perhaps extreme southeastern Durango” (Lemos- Espinal and Dixon 2013: 98). This individual was found in Sierra La Concordia, in the municipality of General Cepeda. Wilson et al. (2013a) calculated its EVS as 13, placing it at the upper end of the medium vulnerability category. Its conservation status has been gauged as Least Concern by IUCN, and this species is not listed by SEMARNAT. *Photo by Michael S. Price.*



No. 6. *Gerrhonotus lugoi* McCoy, 1970. Lugo's Alligator Lizard is a Mexican endemic species restricted to the Cuatro Ciénegas region (Lemos-Espinal et al. 2015). This individual was found at Cuatrociénegas, in the municipality of Cuatrociénegas de Carranza. Wilson et al. (2013a) judged its EVS as 17, placing it in the middle portion of the high vulnerability category. Its conservation status is evaluated as Least Concern by IUCN, and as threatened (A) by SEMARNAT. *Photo by Michael S. Price.*



No. 7. *Gerrhonotus mccoysi* García-Vázquez, Contreras-Arquieta, Trujano-Ortega, and Nieto-Montes de Oca, 2018. McCoy's Alligator Lizard is a Mexican endemic species restricted to the Cuatro Ciénegas region (García-Vázquez et al. 2018). This individual, a male paratype of the species, was encountered at Pozas Azules, Rancho Pronatura in the municipality of Cuatro Ciénegas. The EVS of this species can be calculated as $6+8+3=17$, placing it in the middle portion of the high vulnerability category. Its conservation status has not been evaluated by IUCN, and this species is not listed by SEMARNAT. *Photo by Uri García-Vázquez.*



No. 8. *Crotaphytus antiquus* Axtell and Webb, 1995. The Venerable Collared Lizard occurs from “the Sierras de San Lorenzo, Texas and Solís in extreme western Coahuila” (Lemos-Espinal et al. 2015: 173). This individual was encountered at ca. 8 km SW from the locality of San Antonio del Coyote, in the municipality of Matamoros. Wilson et al. (2013a) determined its EVS as 16, placing it in the middle portion of the high vulnerability category. Its conservation status has been evaluated as Endangered by IUCN, but it has not been listed by SEMARNAT. *Photo by Marco Antonio Bazán-Tellez.*



Fig. 8. *Serranías del Burro*. Panoramic view of the Serranías del Burro, in the municipality of Zaragoza. Photo by Daniel Garza-Tobón.

138 genera of squamates in Mexico, the 44 represented in Coahuila amount to 31.9%. The six turtle genera comprise 33.3% of the 18 genera with representatives in Mexico. The total of 66 genera encompasses 30.6% of the 216 found in Mexico (Johnson et al. 2017).

Species

The herpetofauna of Coahuila represents 143 species, including 20 anurans, four salamanders, 106 squamates, and 13 turtles (Table 3). The 20 anuran species comprise 8.1% of the 247 distributed in Mexico. The four salamander species constitute 2.6% of the 151 found in Mexico. The 106 squamate species make up 12.3% of the 863 located in Mexico. The 13 turtle species amount to 25.5% of the 51 species occurring in Mexico. The total of 143 species comprises 10.8% of the 1,318 species making up the Mexican herpetofauna (Johnson, unpub.).

Comments on the Species List

Some comments on our list of recognized species are necessary, especially as compared to that in Lemos-Espinal and Smith (2016), as follows:

***Eleutherodactylus marnockii*.** Although Lemos-Espinal and Smith (2016) listed this frog as a resident of Coahuila, they provided no evidence based on voucher specimens. In addition, neither Dodd (2013) nor Frost (2018) list this species as occurring in Mexico. Thus, we do not include this species in our analysis.

***Ambystoma velasci*.** Although Lemos-Espinal and Smith (2016) reported *A. mavortium* in Coahuila, we consider populations of *Ambystoma* in southeastern Coahuila to belong to the same species that occurs in nearby Nuevo León, which was identified as *A. velasci* by Nevárez-de los Reyes et al. (2016).

***Gerrhonotus mccoysi*.** Recently, García-Vázquez et al. (2018) described this species from the Cuatro Ciénegas Basin in the Sierras y Llanuras Coahuilenses region.

***Gerrhonotus parvus*.** Until recently, this species was considered endemic to Nuevo León (Lemos-Espinal et al. 2016). Banda-Leal et al. (2018), however, reported it from Sierra de Zapalinamé, Coahuila. Therefore, this species presumably has a continuous distribution throughout the Gran Sierra Plegada region between the type locality (Galeana, Nuevo León) and Sierra Zapalinamé, Coahuila.

***Sceloporus bimaculosus*.** A former subspecies of *S. magister* (elevated by Schulte et al. 2006) was returned to the synonymy of *S. magister* by Leaché and Mulcahy (2007). Curiously, a few sources since then (including Lemos-Espinal and Smith's (2016) most recent checklist on the herpetofauna of Coahuila and the Reptile Database website) referenced the former publication and continued to recognize *S. bimaculosus* as a full species despite a short discussion of that issue by Wilson et al. (2015). In any event, at this point, we herein recognize *S. magister* as the species

of the *S. magister* species group occurring in Coahuila.

***Sceloporus cowlesi*.** Lemos-Espinal and Smith (2016) in their recent checklist reported *Sceloporus consobrinus* for the Coahuila herpetofauna. In a study of the molecular phylogenetics of the *Sceloporus undulatus* species group, however, Leaché (2009) restricted the distribution of *S. consobrinus* to the United States and indicated the member of the *undulatus* group found within Nuevo León to be *S. cowlesi*, which is the name we use here for the Coahuilan populations.

***Sceloporus gadsdeni*.** Díaz-Cárdenas et al. (2017) recently described this species from Sierra de San Lorenzo, near Torreón, in the Bolsón de Mapimí region.

***Sceloporus ornatus*.** Herein we regard *Sceloporus oberon* as a synonym of *Sceloporus ornatus*, based on Martínez-Méndez and Méndez-de la Cruz (2007).

***Sceloporus marmoratus*.** Unlike Lemos-Espinal and Smith (2016), we do not list *S. variabilis* as occurring in Coahuila, but based on Mendoza-Quijano et al. (1998) we do recognize *S. marmoratus* as occurring in the Llanuras de Coahuila y Nuevo León region of Coahuila, instead of *S. variabilis*.

***Lampropeltis annulata*.** *Lampropeltis annulata* was considered an evolutionary species separate from *L. triangulum* by Ruane et al. (2014), who elevated a number of subspecies of *L. triangulum* to full species and synonymized others. Subspecies synonymized with *L. annulata* included *L. t. dixonii*.

***Lampropeltis gentilis*.** The first record for this species from Mexico and Coahuila was reported by Baeza-Tarín et al. (2018a).

***Lampropeltis splendida*.** *Lampropeltis splendida* was elevated to a full species separate from *L. getula* by Pyron and Burbrink (2009).

***Salvadora deserticola*.** Nevárez de los Reyes et al. (2018) first reported this species from Coahuila.

***Tantilla cucullata*.** Baeza-Tarín et al. (2018b) first reported this species for Coahuila.

***Trimorphodon wilkinsonii*.** Baeza-Tarín et al. (2018c) first reported this species for Coahuila.

***Crotalus ornatus*.** Anderson and Greenbaum (2012) resurrected *Crotalus ornatus* from the synonymy of *C. molossus*. *Crotalus ornatus* is found in most parts of Coahuila, whereas *C. molossus* is restricted to the extreme southern parts of the state.

***Apalone atra*.** *Apalone atra* has been either regarded as a subspecies of *A. spinifera* or as a species endemic to the Valley of Cuatro Ciénegas, where *A. spinifera* has gained access to some areas through irrigation channels, thereby allowing some genetic introgression to take place, and driving *A. atra* to a level of being critically susceptible to extinction. Smith and Smith (1979) had already considered *A. atra* to be extinct. Recently, however, pure individuals of *A. atra* have been found, as well as hybrids between the two species (Cerdá-Ardura et al. 2008). See Wilson and Johnson (2010) for a discussion on this issue. Until updated data indicate otherwise, we regard *A. atra* as having viable populations in the Valley of Cuatro Ciénegas, highlighting its need for conservation assessment and action.

Patterns of Physiographic Distribution

Herein 10 physiographic regions are recognized in Coahuila (Fig. 1), and the occurrence of the members of the herpetofauna among these 10 regions are shown in Table 4 and summarized in Table 5.

The total number of species in each region ranges from a low of 38 in the Laguna de Mayrán to a high of 91 in the Sierras y Llanuras Coahuilenses (Table 5). The number of species in each of the other regions is as follows, in ascending order: 40 (Sierra de la Paila); 44 (Llanuras y Sierras Volcánicas); 45 (Bolsón de Mapimí); 45 (Serranías del Burro); 47 (Sierra Transversales); 49 (Pliegues Saltillo Parras); 51 (Gran Sierra Plegada); and 53 (Llanuras de Coahuila y Nuevo León). The lowest value of 38 in the Laguna de Mayrán is 41.8% of the highest value of 91 in the Sierras y Llanuras Coahuilenses. The latter region is the largest in the state, but the former region is not the smallest (the smallest region is the Gran Sierra Plegada).

As expected, the largest absolute and relative numbers of the component herpetofaunal groups are found in the Sierras y Llanuras Coahuilenses, including 14 of 24 species of amphibians (58.3%), 68 of 106 species of squamates (64.2%), and nine of 13 species of turtles (69.2%).

Members of the Coahuilan herpetofauna inhabit from one to all 10 of the 10 physiographic regions, as follows: one (66 of 143 species: 46.2%); two (25; 17.5%); three (11; 7.7%); four (five; 3.5%); five (0; 0%); six (0; 0%); seven (two; 1.4%); eight (five; 3.5%); nine (11; 7.7%); and 10 (18; 12.6%). The most broadly distributed species (occupying all 10 regions) are the anurans *Anaxyrus debilis*, *A. punctatus*, *Lithobates berlandieri*, *Scaphiopus couchii*, and *Spea multiplicata*; the lizards *Crotaphytus collaris*, *Coleonyx brevis*, *Hemidactylus turcicus* (non-native), *Phrynosoma cornutum*, *Sceloporus grammicus*, *S. poinsetti*, and *Aspidoscelis gularis*; and the snakes *Lampropeltis splendida*, *Masticophis flagellum*, *Pantherophis emoryi*, *Pituophis catenifer*, *Rhinocheilus lecontei*, and *Thamnophis marcianus*. Given that Coahuila

Table 4. Distribution of the amphibians, squamates, and turtles of Coahuila, Mexico, by physiographic region. Abbreviations are as follows: BDM = Bolsón de Mapimi; LSV = Llanuras y Sierras Volcánicas; LDM = Laguna de Mayrán; SLC = Sierras y Llanuras Coahuilenses; SDB = Serranías del Burro; SLP = Sierra de la Paila; PSP = Pliegues Saltillo Parras; STR = Sierras Transversales; GSP = Gran Sierra Plegada; and LCN = Llanuras de Coahuila y Nuevo León. * = species endemic to Mexico; ** = species endemic to Coahuila; and *** = non-native species. See text for detailed descriptions of these regions.

Taxa	Physiographic Regions of Coahuila										Number of Regions Occupied
	BDM	LSV	LDM	SLC	SDB	SLP	PSP	STR	GSP	LCN	
Bufonidae (7 species)											
<i>Anaxyrus cognatus</i>	+	+	+	+	+	+	+				7
<i>Anaxyrus debilis</i>	+	+	+	+	+	+	+	+	+	+	10
<i>Anaxyrus punctatus</i>	+	+	+	+	+	+	+	+	+	+	10
<i>Anaxyrus speciosus</i>				+	+	+	+			+	5
<i>Anaxyrus woodhousii</i>	+	+									2
<i>Rhinella horribilis</i>				+						+	2
Craugastoridae (1 species)											
<i>Craugastor augusti</i>				+							1
Eleutherodactylidae (3 species)											
<i>Eleutherodactylus cystignathoides</i>										+	1
<i>Eleutherodactylus gutttilatus</i>				+			+				2
<i>Eleutherodactylus longipes</i> *							+		+		2
Hylidae (4 species)											
<i>Acris blanchardi</i>										+	1
<i>Dryophytes arenicolor</i>				+							1
<i>Rheohyla miotympanum</i> *									+		1
<i>Smilisca baudinii</i>									+		1
Microhylidae (1 species)											
<i>Gastrophryne olivacea</i>	+	+	+	+	+	+	+		+	+	9
Ranidae (2 species)											
<i>Lithobates berlandieri</i>	+	+	+	+	+	+	+	+	+	+	10
<i>Lithobates catesbeianus</i> ***	+			+			+				3
Scaphiopodidae (2 species)											
<i>Scaphiopus couchii</i>	+	+	+	+	+	+	+	+	+	+	10
<i>Spea multiplicata</i>	+	+	+	+	+	+	+	+	+	+	10
Caudata (4 species)											
Ambystomatidae (1 species)											
<i>Ambystoma velasci</i> *								+			1
Plethodontidae (3 species)											
<i>Aquiloerycea galeanae</i> *									+		1
<i>Aquiloerycea scandens</i> *									+		1
<i>Chiropterotriton priscus</i> *									+		1
Squamata (106 species)											
Anguidae (5 species)											
<i>Barisia ciliaris</i> *									+		1
<i>Gerrhonotus infernalis</i>	+	+	+	+	+	+	+	+	+		9
<i>Gerrhonotus lugoi</i> **				+							1
<i>Gerrhonotus mccoysi</i> **				+							1
<i>Gerrhonotus parvus</i> *									+		1
Crotaphytidae (4 species)											
<i>Crotaphytus antiquus</i> **			+								1
<i>Crotaphytus collaris</i>	+	+	+	+	+	+	+	+	+	+	10
<i>Crotaphytus reticulatus</i>										+	1
<i>Gambelia wislizenii</i>				+							1
Eublepharidae (2 species)											
<i>Coleonyx brevis</i>	+	+	+	+	+	+	+	+	+	+	10
<i>Coleonyx reticulatus</i>				+							1
Gekkonidae (1 species)											

The herpetofauna of Coahuila, Mexico

Table 4 (continued). Distribution of the amphibians, squamates, and turtles of Coahuila, Mexico, by physiographic region. Abbreviations are as follows: BDM = Bolsón de Mapimi; LSV = Llanuras y Sierras Volcánicas; LDM = Laguna de Mayrán; SLC = Sierras y Llanuras Coahuilenses; SDB = Serranías del Burro; SLP = Sierra de la Paila; PSP = Pliegues Saltillo Parras; STR = Sierras Transversales; GSP = Gran Sierra Plegada; and LCN = Llanuras de Coahuila y Nuevo León. * = species endemic to Mexico; ** = species endemic to Coahuila; and *** = non-native species. See text for detailed descriptions of these regions.

Taxa	Physiographic Regions of Coahuila										Number of Regions Occupied
	BDM	LSV	LDM	SLC	SDB	SLP	PSP	STR	GSP	LCN	
Phrynosomatidae (29 species)											
<i>Cophosaurus texanus</i>	+	+	+	+	+	+	+	+	+		9
<i>Holbrookia approximans</i> *	+	+	+	+	+	+	+	+	+		9
<i>Holbrookia lacerata</i>										+	1
<i>Phrynosoma cornutum</i>	+	+	+	+	+	+	+	+	+	+	10
<i>Phrynosoma modestum</i>	+	+	+	+	+	+	+	+	+		9
<i>Phrynosoma orbiculare</i> *								+	+		2
<i>Sceloporus cautus</i> *								+			1
<i>Sceloporus couchii</i> *				+		+	+	+			4
<i>Sceloporus cowlesi</i>	+	+	+	+	+	+	+	+	+		9
<i>Sceloporus cyanogenys</i>				+						+	2
<i>Sceloporus cyanostictus</i> *							+	+			2
<i>Sceloporus gadsdeni</i> **	+										1
<i>Sceloporus goldmani</i> *								+			1
<i>Sceloporus grammicus</i>	+	+	+	+	+	+	+	+	+	+	10
<i>Sceloporus maculosus</i> *	+							+			2
<i>Sceloporus magister</i>		+		+		+					3
<i>Sceloporus marmoratus</i>										+	1
<i>Sceloporus merriami</i>				+		+		+		+	4
<i>Sceloporus minor</i> *									+		1
<i>Sceloporus olivaceus</i>				+	+						2
<i>Sceloporus ornatus</i> *							+	+			2
<i>Sceloporus parvus</i> *							+		+		2
<i>Sceloporus poinsettii</i>	+	+	+	+	+	+	+	+	+	+	10
<i>Sceloporus samcolemanni</i> *								+			1
<i>Sceloporus spinosus</i> *								+			1
<i>Uma exsul</i> **	+										1
<i>Uma paraphygas</i> *	+										1
<i>Urosaurus ornatus</i>		+		+	+						3
<i>Uta stansburiana</i>	+	+	+	+		+	+	+	+		8
Scincidae (3 species)											
<i>Plestiodon dicei</i> *									+		1
<i>Plestiodon obsoletus</i>	+	+	+	+	+	+	+	+		+	9
<i>Plestiodon tetragrammus</i>				+	+					+	3
Sphenomorphidae (3 species)											
<i>Scincella kikaapoa</i> **				+							1
<i>Scincella lateralis</i>				+							1
<i>Scincella silvicola</i> *									+		1
Teiidae (4 species)											
<i>Aspidoscelis gularis</i>	+	+	+	+	+	+	+	+	+	+	10
<i>Aspidoscelis inornata</i>	+	+	+	+	+	+	+	+	+		9
<i>Aspidoscelis marmorata</i>	+	+	+	+	+	+	+	+			8
<i>Aspidoscelis tessellata</i>		+		+							2
Xantusiidae (1 species)											
<i>Xantusia extorris</i> *								+			1
Colubridae (29 species)											
<i>Arizona elegans</i>	+	+	+	+	+	+	+			+	8
<i>Bogertophis subocularis</i>	+	+	+	+	+	+	+				7
<i>Coluber constrictor</i>				+							1

Table 4 (continued). Distribution of the amphibians, squamates, and turtles of Coahuila, Mexico, by physiographic region. Abbreviations are as follows: BDM = Bolsón de Mapimi; LSV = Llanuras y Sierras Volcánicas; LDM = Laguna de Mayrán; SLC = Sierras y Llanuras Coahuilenses; SDB = Serranías del Burro; SLP = Sierra de la Paila; PSP = Pliegues Saltillo Parras; STR = Sierras Transversales; GSP = Gran Sierra Plegada; and LCN = Llanuras de Coahuila y Nuevo León. * = species endemic to Mexico; ** = species endemic to Coahuila; and *** = non-native species. See text for detailed descriptions of these regions.

Taxa	Physiographic Regions of Coahuila										Number of Regions Occupied
	BDM	LSV	LDM	SLC	SDB	SLP	PSP	STR	GSP	LCN	
<i>Gyalopion canum</i>				+						+	2
<i>Lampropeltis alterna</i>				+			+				2
<i>Lampropeltis annulata</i>				+						+	2
<i>Lampropeltis gentilis</i>										+	1
<i>Lampropeltis leonis</i> *									+		1
<i>Lampropeltis splendida</i>	+	+	+	+	+	+	+	+	+	+	10
<i>Masticophis flagellum</i>	+	+	+	+	+	+	+	+	+	+	10
<i>Masticophis schotti</i>										+	1
<i>Masticophis taeniatus</i>	+	+	+	+							4
<i>Opheodrys aestivus</i>				+							1
<i>Pantherophis bairdi</i>				+							1
<i>Pantherophis emoryi</i>	+	+	+	+	+	+	+	+	+	+	10
<i>Pituophis catenifer</i>	+	+	+	+	+	+	+	+	+	+	10
<i>Pituophis deppei</i> *								+	+		2
<i>Rhinocheilus lecontei</i>	+	+	+	+	+	+	+	+	+	+	10
<i>Salvadora deserticola</i>										+	1
<i>Salvadora grahamiae</i>				+							1
<i>Sonora episcopa</i>	+	+	+	+	+	+	+	+			8
<i>Tantilla atriceps</i>				+							1
<i>Tantilla cucullata</i>										+	1
<i>Tantilla gracilis</i>										+	1
<i>Tantilla hobartsmithi</i>				+							1
<i>Tantilla nigriceps</i>										+	1
<i>Tantilla wilcoxi</i>							+				1
<i>Trimorphodon vilkinsonii</i>										+	1
Dipsadidae (4 species)											
<i>Diadophis punctatus</i>				+	+		+				3
<i>Heterodon kennerlyi</i>	+	+	+	+	+	+	+	+		+	9
<i>Hypsiglena jani</i>	+	+	+	+	+	+	+	+	+		9
<i>Leptodeira septentrionalis</i>				+							1
Elapidae (1 species)											
<i>Micrurus tener</i>				+					+	+	3
Leptotyphlopidae (3 species)											
<i>Rena dissecta</i>				+							1
<i>Rena dulcis</i>				+						+	2
<i>Rena segregata</i>		+		+	+						3
Natricidae (7 species)											
<i>Nerodia erythrogaster</i>				+						+	2
<i>Nerodia rhombifer</i>										+	1
<i>Storeria hidalgoensis</i> *									+		1
<i>Thamnophis cyrtopsis</i>				+							1
<i>Thamnophis exsul</i> *									+		1
<i>Thamnophis marciianus</i>	+	+	+	+	+	+	+	+	+	+	10
<i>Thamnophis proximus</i>				+						+	2
Viperidae (10 species)											
<i>Agkistrodon laticinctus</i>				+	+						2
<i>Crotalus atrox</i>	+	+	+	+	+	+	+	+	+		9
<i>Crotalus lepidus</i>				+			+		+		3
<i>Crotalus molossus</i>								+	+		2

Table 4 (continued). Distribution of the amphibians, squamates, and turtles of Coahuila, Mexico, by physiographic region. Abbreviations are as follows: BDM = Bolsón de Mapimi; LSV = Llanuras y Sierras Volcánicas; LDM = Laguna de Mayrán; SLC = Sierras y Llanuras Coahuilenses; SDB = Serranías del Burro; SLP = Sierra de la Paila; PSP = Pliegues Saltillo Parras; STR = Sierras Transversales; GSP = Gran Sierra Plegada; and LCN = Llanuras de Coahuila y Nuevo León. * = species endemic to Mexico; ** = species endemic to Coahuila; and *** = non-native species. See text for detailed descriptions of these regions.

Taxa	Physiographic Regions of Coahuila										Number of Regions Occupied
	BDM	LSV	LDM	SLC	SDB	SLP	PSP	STR	GSP	LCN	
<i>Crotalus ornatus</i>				+							1
<i>Crotalus pricei</i>									+		1
<i>Crotalus scutulatus</i>	+	+	+	+		+	+	+	+		8
<i>Crotalus viridis</i>				+							1
<i>Sistrurus tergeminus</i>				+							1
Testudines (13 species)											
Emydidae (6 species)											
<i>Pseudemys gorzugi</i>				+	+					+	3
<i>Terrapene coahuila</i> **				+							1
<i>Terrapene ornata</i>		+									1
<i>Trachemys gaigeae</i>		+		+							2
<i>Trachemys scripta</i> ***				+						+	2
<i>Trachemys taylori</i> **				+							1
Kinosternidae (3 species)											
<i>Kinosternon durangoense</i> *	+										1
<i>Kinosternon flavescens</i>				+						+	2
<i>Kinosternon hirtipes</i>								+			1
Testudinidae (2 species)											
<i>Gopherus berlandieri</i>				+	+		+			+	4
<i>Gopherus flavomarginatus</i> *	+										1
Trionychidae (2 species)											
<i>Apalone atra</i> **				+						+	2
<i>Apalone spinifera</i>				+							1

borders the US state of Texas, it is not surprising that all 18 of these species, including the introduced species *Hemidactylus turcicus*, also are distributed in the USA.

Of the 143 species comprising the Coahuilan herpetofauna, 91 (63.6%) are found in only one or two physiographic regions, which is of great conservation significance (see below). The mean regional occupancy is 3.5.

Single-region species: Limited distribution increases conservation concern. The number of species found in a single region varies from one (in the Laguna de Mayrán, Llanuras y Sierras Volcánicas, and Pliegues Saltillo-Parras) to 23 (in the Sierras y Llanuras Coahuilenses). No single-region species are found in the Serranías del Burro region. On the following lists, * = endemic to Mexico, but found in more than one state; and ** = endemic to Coahuila.

Of the 23 single-region species in the Sierras y Llanuras Coahuilenses listed here by taxonomic order, 17 are Mexican non-endemics and the other six are endemic only within the boundaries of Coahuila.

- Craugastor augusti*
- Dryophytes arenicolor*
- Gerrhonotus lugoi***

- Gerrhonotus mccoysi***
- Gambelia wislizenii*
- Coleonyx reticulatus*
- Scincella kikaapoa***
- Scincella lateralis*
- Coluber constrictor*
- Opheodrys aestivus*
- Pantherophis bairdi*
- Salvadora grahamiae*
- Tantilla atriceps*
- Tantilla hobartsmithi*
- Leptodeira septentrionalis*
- Rena dissecta*
- Thamnophis cyrtopsis*
- Crotalus ornatus*
- Crotalus viridis*
- Sistrurus tergeminus*
- Terrapene coahuila***
- Trachemys taylori***
- Apalone atra***

Of the 15 single-region species in the Gran Sierra Plegada listed here, 13 are country endemics and the other two are Mexican non-endemics.

- Rheohyla miotympanum**

Table 5. Summary of distribution occurrence of herpetofaunal families in Coahuila, Mexico, by physiographic province. See Table 4 for explanation of abbreviations.

Families	Number of Species	Distributional Occurrence									
		BDM	LSV	LDM	SLC	SDB	SLP	PSP	STR	GSP	LCN
Bufonidae	7	4	4	3	6	5	4	4	2	2	5
Craugastoridae	1	—	—	—	1	—	—	—	—	—	—
Eleutherodactylidae	3	—	—	—	1	—	—	2	—	1	1
Hylidae	4	—	—	—	1	—	—	—	—	2	1
Microhylidae	1	1	1	1	1	1	1	1	—	1	1
Ranidae	2	2	1	1	2	1	1	2	1	1	1
Scaphiropodidae	2	2	2	2	2	2	2	2	2	2	2
Subtotals	20	9	8	7	14	9	8	11	5	9	11
Ambystomatidae	1	—	—	—	—	—	—	—	1	—	—
Plethodontidae	3	—	—	—	—	—	—	—	—	3	—
Subtotals	4	—	—	—	—	—	—	—	1	3	—
Totals	24	9	8	7	14	9	8	11	6	12	11
Anguidae	5	1	1	1	3	1	1	1	1	3	—
Crotaphytidae	4	1	1	2	2	1	1	1	1	1	2
Eublepharidae	2	1	1	1	2	1	1	1	1	1	1
Gekkonidae	1	1	1	1	1	1	1	1	1	1	1
Phrynosomatidae	29	12	10	8	14	9	11	12	18	11	7
Scincidae	3	1	1	1	2	2	1	1	1	1	2
Sphenomorphidae	3	—	—	—	2	—	—	—	—	1	—
Teiidae	4	3	4	3	4	3	3	3	3	2	1
Xantusiidae	1	—	—	—	—	—	—	—	1	—	—
Subtotals	52	20	19	17	30	18	19	20	27	21	14
Colubridae	29	9	9	9	19	9	8	10	7	7	16
Dipsadidae	4	2	2	2	4	3	2	3	2	1	1
Elapidae	1	—	—	—	1	—	—	—	—	1	1
Leptotyphlopidae	3	—	1	—	3	1	—	—	—	—	1
Natricidae	7	1	1	1	4	1	1	1	1	3	4
Viperidae	10	2	2	2	7	2	2	3	3	6	—
Subtotals	54	14	15	14	38	16	13	17	13	18	23
Emydidae	6	—	2	—	5	1	—	—	—	—	2
Kinosternidae	3	1	—	—	1	—	—	—	1	—	1
Testudinidae	2	1	—	—	1	1	—	1	—	—	1
Trionychidae	2	—	—	—	2	—	—	—	—	—	1
Subtotals	13	2	2	—	9	2	—	1	1	—	5
Totals	119	36	36	31	77	36	32	38	41	39	42
Sum Totals	143	45	44	38	91	45	40	49	47	51	53

Smilisca baudinii
*Aquiloerycea galeanae**
*Aquiloerycea scandens**
*Chiropterotriton priscus**
*Barisia imbricata**
*Gerrhonotus parvus**
*Sceloporus minor**
*Plestiodon dicei**
*Scincella silvicola**
*Lampropeltis leonis**
*Storeria hidalgoensis**
*Thamnophis exsul**
*Crotalus morulus**
Crotalus pricei

All of the 12 single-region species in the Llanuras de Coahuila y Nuevo León listed here are non-endemic to Mexico:

Eleutherodactylus cystignathoides
Acris blanchardi
Crotaphytus reticulatus
Holbrookia lacerata
Sceloporus marmoratus
Masticophis schotti
Salvadora deserticola
Tantilla cucullata
Tantilla gracilis
Tantilla nigriceps
Trimorphodon vilkinsonii
Nerodia rhombifer

Six of the seven single-region species in the Sierras Transversales listed here are country endemics and the other is a non-endemic:

*Ambystoma velasci**
*Sceloporus cautus**
*Sceloporus goldmani**
*Sceloporus samcolemani**
*Sceloporus spinosus**
*Xantusia extorris**
Kinosternon hirtipes

Three of the five single-region species in the Bolsón de Mapimí are country endemics, and the other two are state endemics:

*Sceloporus gadsdeni***
*Uma exsul***
*Uma paraphygas**
*Kinosternon durangoense**
*Gopherus flavomarginatus**

The single-region species in the Laguna de Mayrán is a state endemic lizard:

Crotaphytus antiquus

The one single-region species in the Llanuras y Sierras Volcánicas is a non-endemic turtle:

Terrapene ornata

The one single-region species in the Pliegues Saltillo-Parras is a non-endemic snake:

Tantilla wilcoxi

Examination of the above-listed species indicates that of the 65 single-region species in Coahuila, 22 are country endemics and nine are state endemics. The remaining 34 are non-endemic species that are also distributed in the USA.

Coefficient of Biogeographic Resemblance. A Coefficient of Biogeographic Resemblance (CBR) matrix was created for examining herpetofaunal relationships among the 10 physiographic regions of Coahuila (Table 6) and these data were used to produce a UPGMA dendrogram (Fig. 12). As mentioned above, the numbers of species within the 10 physiographic regions of Coahuila range from a high of 91 species within the Sierras y Llanuras Coahuilenses (SLC) to a low of 38 within Laguna de Mayrán (LDM). The mean species richness number for all 10 regions is 50.3. The numbers of species shared between regions range from 20 to 45. The lowest value of 20 is found between only one pair of regions, the Llanuras de Coahuila y Nuevo León (LCN) and Gran Sierra Plegada (GSP). The highest number is also shared between only one pair of regions, the SLC and Serranías del Burro (SDB). The mean number of shared species among the 45 regional pairings is 32.9. The lowest number of 20 shared species between LCN and GSP makes biogeographic sense because these two regions are situated at opposite ends of the state, are not connected geographically, and are environmentally quite different: LCN contains subhumid lowland plains and hills versus GSP with semihumid to subhumid highland mountainous areas carved by deep valleys. Also, GSP has a much smaller area in Coahuila than does LCN. On the other hand, the two regions with the highest number of 45 shared species are SLC and SDB. These two regions share part of their borders and both contain similar ecological regimes. Unlike the situation in Tamaulipas (Terán-Juárez et al. 2016), the higher numbers of species in the regional pairings in Coahuila, with the exception of SLC (91 species), do not necessarily equate to higher numbers of shared species, which is more similar to the patterns shown in adjacent Nuevo León (Navárez-de los Reyes et al. 2016). This discrepancy is most likely due to the larger number of included physiographic regions, and the lower number of shared species from more distant regions. Reflecting this trend, the following

Table 6. Pair-wise comparison matrix of Coefficient of Biogeographic Resemblance (CBR) data of herpetofaunal relationships for the 10 physiographic regions in Coahuila, Mexico. Underlined values = number of species in each region; upper triangular matrix values = species in common between two regions; and lower triangular matrix values = CBR values. The formula for this algorithm is $CBR = 2C/N_1 + N_2$ (Duellman 1990), where C is the number of species in common to both regions, N_1 is the number of species in the first region, and N_2 is the number of species in the second region. See Table 4 for explanation of abbreviations and Fig. 12 for the UPGMA dendrogram produced from the CBR data.

	BDM	LSV	LDM	SLC	SDB	SLP	PSP	STR	GSP	LCN
BDM	<u>45</u>	38	37	38	34	36	37	33	29	22
LSV	0.85	<u>44</u>	37	42	36	37	36	32	29	22
LDM	0.89	0.90	<u>38</u>	37	34	36	36	32	29	22
SLC	0.56	0.62	0.57	<u>91</u>	45	40	44	34	31	40
SDB	0.76	0.81	0.82	0.66	<u>45</u>	35	37	30	27	28
SLP	0.85	0.88	0.92	0.61	0.74	<u>40</u>	38	34	29	24
PSP	0.79	0.80	0.83	0.63	0.79	0.85	<u>49</u>	35	32	24
STR	0.72	0.70	0.75	0.49	0.65	0.78	0.73	<u>47</u>	31	21
GSP	0.60	0.61	0.65	0.44	0.56	0.64	0.64	0.63	<u>51</u>	20
LCN	0.45	0.45	0.48	0.56	0.57	0.52	0.47	0.42	0.38	<u>53</u>

pairwise comparisons of regions are aligned in order of highest to lowest species richness (underlined values) and their corresponding numbers of shared species (in parentheses) with all other regions; see text and map for discussions on characteristics and sizes of the regions:

SLC 91: SDB (45), SLP (40), PSP (44), STR (34), GSP (31), LCN (40), LDM (32), LSV (42), BDM (38).

LCN 53: GSP (20), STR (21), PSP (24), SLP (24), SDB (28), SLC (40), LDM (22), LSV (23), BDM (22).

GSP 51: LCN (20), STR (31), PSP (32), SLP (29), SDB (27), SLC (31), LDM (29), LSV (29), BDM (29).

PSP 49: STR (35), GSP (32), LCN (24), SLP (38), SDB (37), SLC (44), LDM (36), LSV (36), BDM (37).

STR 47: GSP (31), LCN (21), PSP (35), SLP (34), SDB (30), SLC (34), LDM (32), LSV (32), BDM (33).

SDB 45: SLP (35), PSP (27), STR (30), GSP (27), LCN (28), SLC (45), LDM (34), LSV (36), BDM (34).

BDM 45: LSV (38), LDM (37), SLC (38), SDB (34), SLP (36), PSP (37), STR (33), GSP (29), LCN (22).

LSV 44: BDM (38), LDM (37), SLC (42), SDB (36), SLP (37), PSP (36), STR (32), GSP (29), LCN (22).

SLP 40: BDM (36), LSV (37), LDM (36), SLC (40), SDB (35), PSP (38), STR (34), GSP (29), LCN (24).

LDM 38: BDM (37), SLP (36), PSP (36), STR (32), GSP (29), LCN (22), SLC (37), SDB (34), LSV (34).

SLC, with its 91 species, is the largest physiographic region in Coahuila that shares borders to variable extents with five of the nine other regions in the state (LCN, SDB, PSP, LSV, SLP), including the 2nd and 4th most speciose regions (LCN, PSP). The 91 species in SLC reveals a large discrepancy between it and all nine other regions in the state. Ninety-one species is 38 more than found in LCN, the second most species-rich region with 53 species, whereas the total difference for all nine of the

other regions is only 15 species between the 53 species in LCN and the 38 species in LDM. LCN is a lowland region next to the Rio Grande with few montane landscapes, but it contains several generalist herpetofaunal species that also exist in adjacent montane regions of Coahuila at lower elevations. PSP is mostly separated from LCN by two other regions to its north (LDM, SLP); however, it shares a geographic connection through a northwestern extension of PSP in Nuevo León (Nevárez-de los Reyes et al. 2016).

The following data show ranges and mean numbers of shared species for each of the 10 regions listed above that are arranged according to increasing mean numbers (bold in parentheses) with underlined values referring to species richness in each region:

Llanuras de Coahuila y Nuevo León (LCN) (53): 20–40 (**24.7**)

Gran Sierra Plegada - GSP (51): 20–32 (**28.5**)

Sierras Transversales - STR (47): 21–35 (**31.3**)

Laguna de Mayrán - LGM (38): 22–37 (**33.3**)

Bolsón de Mapimí - BDM (45): 22–38 (**33.8**)

Serranías del Burro - SDB (45): 27–45 (**34.0**)

Llanuras y Sierras Volcánicas - LSV (44): 22–42 (**34.3**)

Sierra de la Paila - SLP (40): 24–40 (**34.3**)

Pliegues de Saltillo Parras - PSP (49): 24–38 (**35.4**)

Sierras y Llanuras Coahuilenses - SLC (91): 31–45 (**39.0**)

With the exception of SLC and PSP (1st and 4th highest in species richness, and 1st and 2nd highest mean numbers of shared species, respectively), the mean number of pairwise species comparisons between all other regions indicate that higher species richness in a region does not necessarily translate into a higher mean number of shared species when all regions are totaled. Apparent extreme examples of this are: LCN, GSP, and STR, respectively, having the 1st, 2nd, and 3rd highest numbers of species and lowest mean numbers of shared species. It makes sense that LCN would share fewer species with other regions in Coahuila because of its ecological uniqueness



Fig. 9. *Sierras y Llanuras Coahuilenses*. Vegetation in the Valley of Cuatrociénegas, in the municipality of Cuatrociénegas de Carranza. Photo by Elí García-Padilla.



Fig. 10. *Sierra de la Paila*. Vegetation in the Sierra de la Paila, in the municipality of Ramos Arizpe. Photo by Bernardo Marino (<http://gransierraplegada.org>).



Fig. 11. *Sierras Transversales*. Paso de Carneros, Matorral rosetophilous vegetation, with Chocha (*Yucca carnerosana*) and Lechuguilla (*Agave lechuguilla*), at Paso de Carneros, in the municipality of Saltillo. Photo by Manuel Nevárez de los Reyes.

associated with lower elevations and general differences in vegetation formations and topography, as well as herpetofaunal affinities to the United States northward across the Rio Grande. GSP has the smallest area of all regions in the state, but is much more extensive when considering it also exists in Nuevo León and Tamaulipas (Nevárez-de los Reyes et al. 2016; Terán-Juárez et al. 2016). STR is a slender montane region with high species richness positioned primarily within Coahuila across its entire southern border.

UPGMA Dendrogram. Based on the data in Table 6, a UPGMA dendrogram (Fig. 12) was created to illustrate the herpetofaunal resemblance patterns in a hierarchical fashion among the 10 physiographic regions of Coahuila (Fig. 1). The patterns are different when compared to those shown in the two other northern Mexico states bordering Texas that were covered in previous MCS publications: Nuevo León (Nevárez-de los Reyes et al. 2016) and Tamaulipas (Terán-Juárez et al. 2016). The Coahuila dendrogram shows the similarity relationships in descending order from the most similar regions, SLP clustering with LDM at a value of 0.92, down to the lowest value, where LCN clusters with all the other regions at a value of 0.48. In other words, there are no

distinct subgroupings within the dendrogram, which indicates on a biogeographic scale that there are no distinct subgroups composed of distributional units that share more closely related herpetofaunas. On the other hand, neighboring Nuevo León with seven regions has two distinct biogeographic subgroups, a southern unit containing two regions and a more northern unit containing five regions that clusters with the southern unit at the 0.37 similarity level. Tamaulipas, also with seven recognized regions, has the most complex pattern of herpetological similarity of these three states. Two biogeographic subgroups are found in what can be considered the northern and eastern sections of the state. One of those subgroups contains three regions that make up the majority of the state's area, while the other subgroup is comprised of two small disjunct highland regions that cluster together at the 0.55 level; and both are nested within one of the other subgroup's regions. Those two subgroups cluster with each other at the 0.46 similarity level. One of the two remaining regions, which make up the extreme southwestern sector of Tamaulipas, clusters independently with the other two biogeographic subgroups at the 0.44 level of herpetofaunal similarity. The last region, which is the southwestern-most section of the state, is the most distinctive of the seven, thereby clustering with the others at the 0.23 level of herpetological similarity.

In summary, the UPMGA dendrogram for Coahuila shows that the lowland non-montane region (LCN) bordering the Rio Grande and Texas is the most distinctive region in Coahuila as far as herpetological similarity goes, based on numbers of shared species. It also shows a pattern of similarity among regions in close proximity to each other that also share ecological parameters either within the state or through areas of the same physiographic region outside Coahuila.

Distribution Status Categorizations

The discussion of the distribution status of Coahuilan herpetofauna members uses the system developed by Alvarado-Díaz et al. (2013), and employed in all the

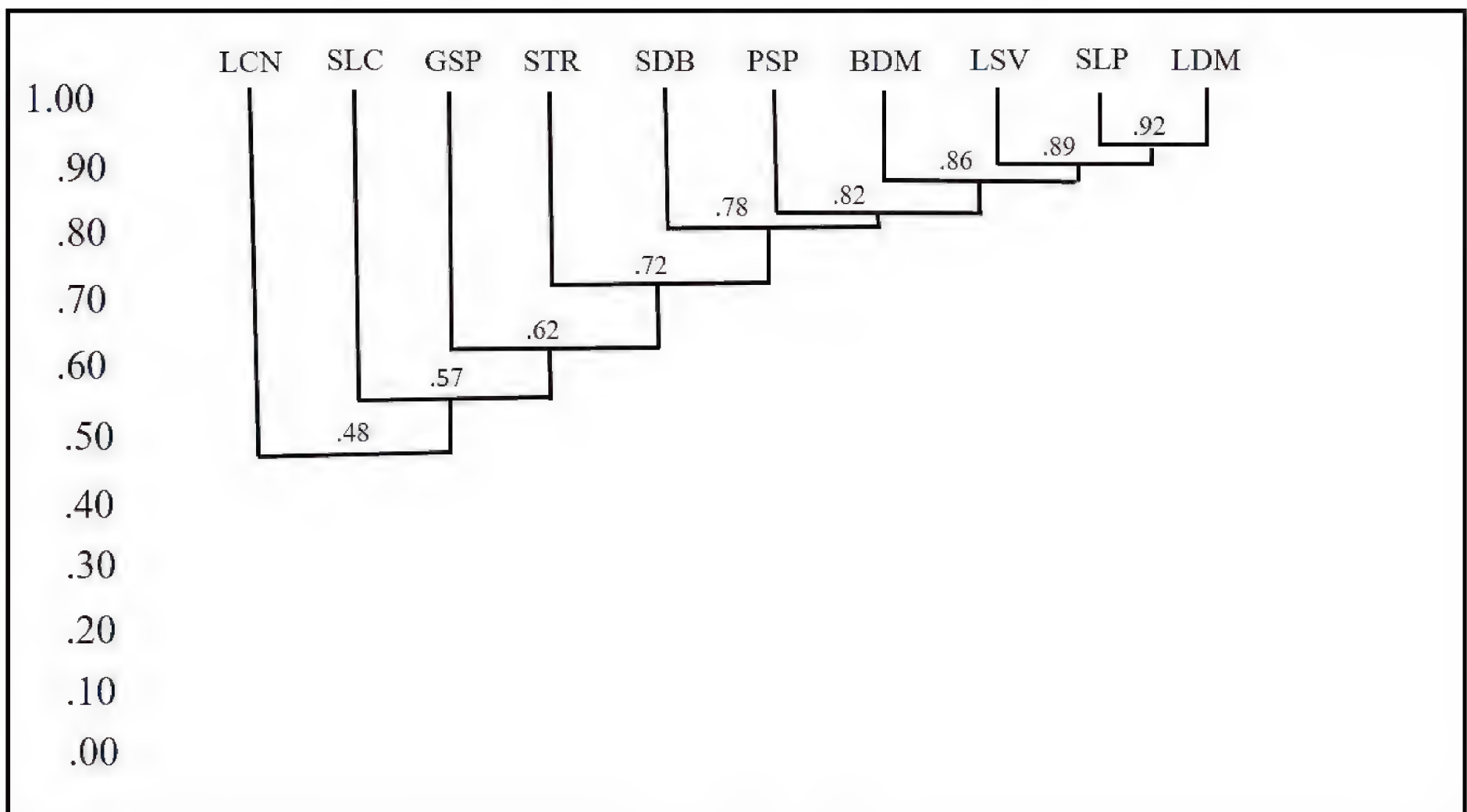


Fig. 12. A UPGMA generated dendrogram illustrating the similarity relationships of species richness among the herpetofauna in the 10 physiographic regions of Coahuila (based on the data in Table 6). We calculated the similarity values using Duellman's (1990) Coefficient of Biogeographic Resemblance (CBR).

other entries in the Mexican Conservation Series. The categories in the system are non-endemic, country endemic, state endemic, and non-native (Tables 7 and 8).

Given the 512-km-long border shared between Coahuila and Texas (<http://wikipedia.org>; accessed 11 August 2018), it is not surprising that the largest component of the herpetofauna falls into the non-endemic category. Of the 143 species comprising the Coahuilan herpetofauna, 100 species (69.9% of the total) belong to this category. Almost half (49) of the non-endemic species are snakes, and this number is only five fewer than the total number of snake species in the entire herpetofauna (Table 8). The 76 non-endemic squamate species are 71.7% of the total of 106 species for the state. In addition, a large portion of the state's anurans (17 of 20; 85.0%) are also non-endemic species. On the other hand, slightly more than half the turtle species (seven of 13; 53.8%) are non-endemic to Coahuila (Table 8).

The next largest component is the 31 (21.7%) country endemic species, most of which are squamates, including 18 lizards and five snakes (74.2%). The remainder are amphibians (six species; 19.4%) and turtles (two species; 6.5%). Almost half of the country endemics are phrynosomatid lizards (14 of 31; 45.2%).

Only nine of the species (6.3%) in Coahuila are state endemics. Six of these are lizards (*Gerrhonotus lugoi*, *G. mccoysi*, *Crotaphytus antiquus*, *Sceloporus gadsdeni*, *Uma exsul*, and *Scincella kikaapoa*) and three are turtles (*Terrapene coahuila*, *Trachemys taylori*, and *Apalone atra*).

The number of non-native species in Coahuila is only three, the ranid frog *Lithobates catesbeianus*, the

gekkonid lizard *Hemidactylus turcicus*, and the emydid turtle *Trachemys scripta*. These three species also were reported as introduced into Nuevo León (Nevárez-de los Reyes et al. 2016).

The number of endemic species in Coahuila (country and state endemics combined) is 40, which is 4.9% of the total number of endemic species for Mexico (811; Johnson unpub.). The number of non-endemic species is 100, which is 19.7% of the total of such species in the entirety of Mexico (508; Johnson unpub.).

Principal Environmental Threats

In this section we examine the 12 problems we think are the most significant in affecting the sustainability of the populations of Coahuila's amphibians and reptiles.

Urban development. As of 2015, the population of Coahuila was 2,954,915, making it the 16th most densely populated state in Mexico. The Municipality of Saltillo is the most populated of the 38 municipalities in the state, with a population of 807,537 people, followed by the municipalities of Torreón with 679,288, Monclova with 231,107, and Piedras Negras with 163,595 (see INEGI, <http://www.beta.inegi.org.mx/temas/estructura/>). Data from this same website indicate that 90% of the state population is located in urban areas, with the remainder in rural areas. The current annual percentage growth rate is 1.5%, which portends a doubling rate of about 47 years. Most of this growth is expected to occur within the most heavily-populated municipalities.

The herpetofauna of Coahuila, Mexico

Table 7. Distributional and conservation status measures for members of the herpetofauna of Coahuila, Mexico. Distributional Status: SE = endemic to state of Coahuila; CE = endemic to country of Mexico; NE = not endemic to state or country; and NN = non-native. Environmental Vulnerability Score (taken from Wilson et al. 2013a,b): low (L) vulnerability species (EVS of 3–9); medium (M) vulnerability species (EVS of 10–13); and high (H) vulnerability species (EVS of 14–20). IUCN Categorization: CR = Critically Endangered; EN = Endangered; VU = Vulnerable; NT = Near Threatened; LC = Least Concern; DD = Data Deficient; NE = Not Evaluated. SEMARNAT Status: A = Threatened; P = Endangered; Pr = Special Protection; and NS = No Status. * = species endemic to Mexico; ** = species endemic to Coahuila; *** = non-native species. See text for explanations of the EVS, IUCN, and SEMARNAT rating systems.

Taxa	Distributional Status	Environmental Vulnerability Category (Score)	IUCN Categorization	SEMARNAT Status
<i>Anaxyrus cognatus</i>	NE	L (9)	LC	NS
<i>Anaxyrus debilis</i>	NE	L (7)	LC	Pr
<i>Anaxyrus punctatus</i>	NE	L (5)	LC	NS
<i>Anaxyrus speciosus</i>	NE	M (12)	LC	NS
<i>Anaxyrus woodhousii</i>	NE	M (10)	LC	NS
<i>Incilius nebulifer</i>	NE	L (6)	LC	NS
<i>Rhinella horribilis</i>	NE	L (3)	LC	NS
<i>Craugastor augusti</i>	NE	L (8)	LC	NS
<i>Eleutherodactylus cystignathoides</i>	NE	M (12)	LC	NS
<i>Eleutherodactylus guttilatus</i>	NE	M (11)	LC	NS
<i>Eleutherodactylus longipes</i> *	CE	H (15)	VU	NS
<i>Acris blanchardi</i>	NE	M (12)	NE	NS
<i>Dryophytes arenicolor</i>	NE	L (7)	LC	NS
<i>Rheohyla miotympanum</i> *	CE	L (9)	NT	NS
<i>Smilisca baudinii</i>	NE	L (3)	LC	NS
<i>Gastrophryne olivacea</i>	NE	L (9)	LC	Pr
<i>Lithobates berlandieri</i>	NE	L (7)	LC	Pr
<i>Lithobates catesbeianus</i> ***	NN	—	—	—
<i>Scaphiopus couchii</i>	NE	L (3)	LC	NS
<i>Spea multiplicata</i>	NE	L (6)	LC	NS
<i>Ambystoma velasci</i> *	CE	M (10)	LC	Pr
<i>AquiloEURYCEA galeanae</i> *	CE	H (18)	NT	A
<i>AquiloEURYCEA scandens</i> *	CE	H (17)	VU	Pr
<i>Chiropterotriton priscus</i> *	CE	H (16)	NT	Pr
<i>Barisia ciliaris</i> *	CE	H (15)	NE	NS
<i>Gerrhonotus infernalis</i>	NE	M (13)	LC	NS
<i>Gerrhonotus lugoi</i> **	SE	H (16)	LC	NS
<i>Gerrhonotus mccoysi</i> **	SE	H (17)	NE	NS
<i>Gerrhonotus parvus</i> *	CE	H (17)	EN	Pr
<i>Crotaphytus antiquus</i> **	SE	H (16)	EN	NS
<i>Crotaphytus collaris</i>	NE	M (13)	LC	A
<i>Crotaphytus reticulatus</i>	NE	M (12)	VU	A
<i>Gambelia wislizenii</i>	NE	M (13)	LC	Pr
<i>Coleonyx brevis</i>	NE	H (14)	LC	Pr
<i>Coleonyx reticulatus</i>	NE	H (15)	LC	Pr
<i>Hemidactylus turcicus</i> ***	NN	—	—	—
<i>Cophosaurus texanus</i>	NE	H (14)	LC	A
<i>Holbrookia approximans</i> *	CE	H (14)	NE	NS
<i>Holbrookia lacerata</i>	NE	H (14)	NT	A
<i>Phrynosoma cornutum</i>	NE	M (11)	LC	NS
<i>Phrynosoma modestum</i>	NE	M (12)	LC	NS
<i>Phrynosoma orbiculare</i> *	CE	M (12)	LC	A
<i>Sceloporus cautus</i> *	CE	H (15)	LC	NS
<i>Sceloporus couchii</i> *	CE	H (15)	LC	NS
<i>Sceloporus cowlesi</i>	NE	M (13)	NE	NS
<i>Sceloporus cyanogenys</i>	NE	M (13)	NE	NS
<i>Sceloporus cyanostictus</i> *	CE	H (16)	EN	NS

Table 7 (continued). Distributional and conservation status measures for members of the herpetofauna of Coahuila, Mexico. Distributional Status: SE = endemic to state of Coahuila; CE = endemic to country of Mexico; NE = not endemic to state or country; and NN = non-native. Environmental Vulnerability Score (taken from Wilson et al. 2013a,b): low (L) vulnerability species (EVS of 3–9); medium (M) vulnerability species (EVS of 10–13); and high (H) vulnerability species (EVS of 14–20). IUCN Categorization: CR = Critically Endangered; EN = Endangered; VU = Vulnerable; NT = Near Threatened; LC = Least Concern; DD = Data Deficient; NE = Not Evaluated. SEMARNAT Status: A = Threatened; P = Endangered; Pr = Special Protection; and NS = No Status. * = species endemic to Mexico; ** = species endemic to Coahuila; *** = non-native species. See text for explanations of the EVS, IUCN, and SEMARNAT rating systems.

Taxa	Distributional Status	Environmental Vulnerability Category (Score)	IUCN Categorization	SEMARNAT Status
<i>Sceloporus gadsdeni</i> **	SE	H (17)	NE	NS
<i>Sceloporus goldmani</i> *	CE	H (15)	EN	NS
<i>Sceloporus grammicus</i>	NE	L (9)	LC	Pr
<i>Sceloporus maculosus</i> *	CE	H (16)	VU	Pr
<i>Sceloporus magister</i>	NE	L (9)	LC	NS
<i>Sceloporus marmoratus</i>	NE	M (11)	NE	NS
<i>Sceloporus merriami</i>	NE	M (13)	LC	NS
<i>Sceloporus minor</i> *	CE	H (14)	LC	NS
<i>Sceloporus olivaceus</i>	NE	M (13)	LC	NS
<i>Sceloporus ornatus</i> *	CE	H (16)	NT	A
<i>Sceloporus parvus</i> *	CE	H (15)	LC	NS
<i>Sceloporus poinsettii</i>	NE	M (12)	LC	NS
<i>Sceloporus samcolemanni</i> *	CE	H (15)	LC	NS
<i>Sceloporus spinosus</i> *	CE	M (12)	LC	NS
<i>Uma exsul</i> **	SE	H (16)	EN	P
<i>Uma paraphygas</i> *	CE	H (17)	NT	P
<i>Urosaurus ornatus</i>	NE	M (10)	LC	NS
<i>Uta stansburiana</i>	NE	L (7)	LC	A
<i>Plestiodon dicei</i> *	CE	M (12)	NE	NS
<i>Plestiodon obsoletus</i>	NE	M (11)	LC	NS
<i>Plestiodon tetragrammus</i>	NE	M (12)	LC	NS
<i>Scincella kikaapoa</i> **	SE	H (17)	NE	NS
<i>Scincella lateralis</i>	NE	M (13)	LC	Pr
<i>Scincella silvicola</i> *	CE	M (12)	LC	A
<i>Aspidoscelis gularis</i>	NE	L (9)	LC	NS
<i>Aspidoscelis inornata</i>	NE	H (14)	LC	NS
<i>Aspidoscelis marmorata</i>	NE	H (14)	NE	NS
<i>Aspidoscelis tessellata</i>	NE	H (14)	LC	NS
<i>Xantusia extorris</i> *	CE	H (15)	LC	NS
<i>Arizona elegans</i>	NE	L (5)	LC	NS
<i>Bogertophis subocularis</i>	NE	H (14)	LC	NS
<i>Coluber constrictor</i>	NE	M (10)	LC	A
<i>Drymarchon melanurus</i>	NE	L (6)	LC	NS
<i>Gyalopion canum</i>	NE	L (9)	LC	NS
<i>Lampropeltis alterna</i>	NE	H (14)	LC	A
<i>Lampropeltis annulata</i>	NE	M (12)	NE	NS
<i>Lampropeltis gentilis</i>	NE	L (9)	NE	NS
<i>Lampropeltis leonis</i> *	CE	H (16)	NE	NS
<i>Lampropeltis splendida</i>	NE	M (12)	NE	NS
<i>Masticophis flagellum</i>	NE	L (8)	LC	A
<i>Masticophis schotti</i>	NE	M (13)	LC	NS
<i>Masticophis taeniatus</i>	NE	M (10)	LC	NS
<i>Opheodrys aestivus</i>	NE	M (13)	LC	NS
<i>Pantherophis bairdi</i>	NE	H (15)	LC	NS
<i>Pantherophis emoryi</i>	NE	M (13)	LC	NS
<i>Pituophis catenifer</i>	NE	L (9)	LC	NS
<i>Pituophis deppei</i> *	CE	H (14)	LC	A

The herpetofauna of Coahuila, Mexico

Table 7 (continued). Distributional and conservation status measures for members of the herpetofauna of Coahuila, Mexico. Distributional Status: SE = endemic to state of Coahuila; CE = endemic to country of Mexico; NE = not endemic to state or country; and NN = non-native. Environmental Vulnerability Score (taken from Wilson et al. 2013a,b): low (L) vulnerability species (EVS of 3–9); medium (M) vulnerability species (EVS of 10–13); and high (H) vulnerability species (EVS of 14–20). IUCN Categorization: CR = Critically Endangered; EN = Endangered; VU = Vulnerable; NT = Near Threatened; LC = Least Concern; DD = Data Deficient; NE = Not Evaluated. SEMARNAT Status: A = Threatened; P = Endangered; Pr = Special Protection; and NS = No Status. * = species endemic to Mexico; ** = species endemic to Coahuila; *** = non-native species. See text for explanations of the EVS, IUCN, and SEMARNAT rating systems.

Taxa	Distributional Status	Environmental Vulnerability Category (Score)	IUCN Categorization	SEMARNAT Status
<i>Rhinocheilus lecontei</i>	NE	L (8)	LC	NS
<i>Salvadora deserticola</i>	NE	H (14)	NE	NS
<i>Salvadora grahamiae</i>	NE	M (10)	LC	NS
<i>Sonora episcopa</i>	NE	M (13)	NE	NS
<i>Tantilla atriceps</i>	NE	M (11)	LC	A
<i>Tantilla cucullata</i>	NE	M (12)	LC	NS
<i>Tantilla gracilis</i>	NE	M (13)	LC	A
<i>Tantilla hobartsmithi</i>	NE	M (11)	LC	NS
<i>Tantilla nigriceps</i>	NE	M (11)	LC	NS
<i>Tantilla wilcoxi</i>	NE	M (10)	LC	NS
<i>Trimorphodon wilkinsonii</i>	NE	H (15)	LC	A
<i>Diadophis punctatus</i>	NE	L (4)	LC	NS
<i>Heterodon kennerlyi</i>	NE	M (11)	NE	NS
<i>Hypsiglena jani</i>	NE	L (6)	NE	NS
<i>Leptodeira septentrionalis</i>	NE	L (8)	NE	NS
<i>Micrurus tener</i>	NE	M (11)	LC	NS
<i>Rena dissecta</i>	NE	M (11)	LC	NS
<i>Rena dulcis</i>	NE	M (13)	LC	NS
<i>Rena segregata</i>	NE	L (8)	NE	NS
<i>Nerodia erythrogaster</i>	NE	M (11)	LC	A
<i>Nerodia rhombifer</i>	NE	M (10)	LC	NS
<i>Storeria hidalgoensis</i> *	CE	M (13)	VU	NS
<i>Thamnophis cyrtopsis</i>	NE	L (7)	LC	NS
<i>Thamnophis exsul</i> *	CE	H (16)	LC	A
<i>Thamnophis marcianus</i>	NE	M (10)	LC	A
<i>Thamnophis proximus</i>	NE	L (7)	LC	A
<i>Agkistrodon laticinctus</i>	NE	H (15)	NE	NS
<i>Crotalus atrox</i>	NE	L (9)	LC	Pr
<i>Crotalus lepidus</i>	NE	M (12)	LC	Pr
<i>Crotalus molossus</i>	NE	L (8)	LC	Pr
<i>Crotalus morulus</i> *	CE	H (16)	NE	NS
<i>Crotalus ornatus</i>	NE	M (13)	NE	NS
<i>Crotalus pricei</i>	NE	H (14)	LC	Pr
<i>Crotalus scutulatus</i>	NE	M (11)	LC	Pr
<i>Crotalus viridis</i>	NE	M (12)	LC	Pr
<i>Sistrurus tergeminus</i>	NE	M (13)	LC	Pr
<i>Pseudemys gorzugi</i>	NE	H (16)	NT	A
<i>Terrapene coahuila</i> **	SE	H (19)	EN	A
<i>Terrapene ornata</i>	NE	H (15)	NT	Pr
<i>Trachemys gaigeae</i>	NE	H (18)	VU	NS
<i>Trachemys scripta</i> ***	NN	—	—	—
<i>Trachemys taylori</i> **	SE	H (19)	EN	NS
<i>Kinosternon durangoense</i> *	CE	H (16)	DD	NS
<i>Kinosternon flavescens</i>	NE	M (12)	LC	NS
<i>Kinosternon hirtipes</i>	NE	M (10)	LC	Pr
<i>Gopherus berlandieri</i>	NE	H (18)	LC	A
<i>Gopherus flavomarginatus</i> *	CE	H (19)	VU	P
<i>Apalone atra</i> **	SE	H (20)	NE	P
<i>Apalone spinifera</i>	NE	H (15)	LC	Pr



Fig. 13. Urban Development. Urban growth near Saltillo, reaching the limit of the Natural Protected Area “Sierra de Zapalinamé,” in the municipality of Saltillo. *Photo by Manuel Nevárez de los Reyes.*



Fig. 14. Industrial Pollution. Factories polluting the air in the vicinity of Monclova, in the municipality of Monclova. *Photo by Michael Price.*



Fig. 15. Deforestation for Agricultural Purposes. Monoculture of grapes near Parras de la Fuente, in the municipality of Parras. *Photo by Manuel Nevárez de los Reyes.*



Fig. 16. Deforestation for Agricultural Purposes. Monoculture of cotton at San Pedro de las Colonias, in the municipality of the same name, Provincia de Laguna de Mayran. *Photo by Manuel Nevárez de los Reyes.*

Urban pollution. One outcome of urban growth that is of environmental significance is the accumulation of garbage resulting from the inefficient use of resources by populations in urban areas. An extensive recent study acknowledged that “*garbage is the major environmental problem facing Mexico, involving the generation of more than 100 million tons of wastes per year that are not handled in an adequate manner*” (<http://www.estosdias.com.mx/blog/archivos/226>; accessed 18 September 2018). This site points out that the Federal District and its metropolitan area has the largest garbage dump in the world, located in Ciudad Nezahualcóyotl in the State of México. The useful life of this site has been extended despite the lack of additional space being available, which points out the difficulty of finding other sites to deposit the thousands of tons of garbage produced. With reference to Coahuila, in an article published in *Torreón* on 14 August 2018 by *Noticias—El Sol de la Laguna*, the Secretary of the Environment, Eglantina Canales Gutiérrez, reported that 3,000 tons of garbage are produced in the state of Coahuila on a daily basis, or almost one kilogram of trash produced per person

per day. Secretary Canales stated that the burial of such trash in landfills, which are available in 85% of Coahuila, represents the best solution to date, but that in the future efforts to recycle products should be implemented. She decried that often garbage does not end up in landfills, but rather is left out in the open. This environmental problem can be expected to grow commensurate with the rate of human population growth in Coahuila.

Several instances of the direct impact of accumulated garbage on members of the Mexican herpetofauna have been documented. Lazcano et al. (2006) reported the death of several Texas Horned Lizards (*Phrynosoma cornutum*), that were trapped inside a discarded tire in an illegal dump site in the neighboring state of Nuevo León. The lizards, presumably seeking shelter, died after they were unable to escape due to the intense daily temperatures at this locality that can rise to 45 °C in the shade. On another occasion in Nuevo León, Chávez-Cisneros et al. (2010) reported finding a Greater Earless Lizard (*Cophosaurus texanus*) that apparently died after ingesting a deflated balloon left in a pile of litter. The full environmental impact of discarded trash on the native

Table 8. Summary of the distributional status of herpetofaunal families in Coahuila, Mexico.

Families	Number of Species	Distributional Status			
		Non-endemic (NE)	Country Endemic (CE)	State Endemic (SE)	Non-native (NN)
Bufonidae	7	7	—	—	—
Craugastoridae	1	1	—	—	—
Eleutherodactylidae	3	2	1	—	—
Hylidae	4	3	1	—	—
Microhylidae	1	1	—	—	—
Ranidae	2	1	—	—	1
Scaphiopodidae	2	2	—	—	—
Subtotals	20	17	2	—	1
Ambystomatidae	1	—	1	—	—
Plethodontidae	3	—	3	—	—
Subtotals	4	—	4		
Totals	24	17	6	—	1
Anguidae	5	1	2	2	—
Crotaphytidae	4	3	—	1	—
Eublepharidae	2	2	—	—	—
Gekkonidae	1	—	—	—	1
Phrynosomatidae	29	14	13	2	—
Scincidae	3	2	1	—	—
Sphenomorphidae	3	1	1	1	—
Teiidae	4	4	—	—	—
Xantusiidae	1	—	1	—	—
Subtotals	52	27	18	6	1
Colubridae	29	27	2	—	—
Dipsadidae	4	4	—	—	—
Elapidae	1	1	—	—	—
Leptotyphlopidae	3	3	—	—	—
Natricidae	7	5	2	—	—
Viperidae	10	9	1	—	—
Subtotals	54	49	5	—	—
Emydidae	6	3	—	2	1
Kinosternidae	3	2	1	—	—
Testudinidae	2	1	1	—	—
Trionychidae	2	1	—	1	—
Subtotals	13	7	2	3	1
Totals	119	83	25	9	2
Sum Totals	143	100	31	9	3

herpetofauna of Coahuila, and elsewhere in Mexico, is still unknown, so it is imperative that actions be taken to diminish this overtly intentional behavior by an uncaring populace.

Industrial pollution. The municipalities of Acuña, Monclova, Piedras Negras, Ramos Arizpe, Saltillo, and Torreón have a Vehicle Verification Program (PVV) to address vehicular air pollution, which is supervised under municipal authority (Anon 2017).

Coahuila produces 16% of the electric power and 23% of the steel in Mexico. The industry dedicated to the extraction and commercialization of coal, in the coal region around Nava and Piedras Negras, has

been named as the one that most intensively pollutes the air (Journalistic note of May 4, 2016, <http://www.vanguardia.com.mx/articulo/empresas-carboneras-las-que-mas-contaminan-el-aire-en-la-carbonifera-y-norte-de-coahuila>).

Deforestation for agricultural and ranching purposes. One of the most notorious cases of massive deforestation carried out in the state of Coahuila happened in 2001. It occurred in the Valle del Hundido, adjacent to the Cuatro Ciénegas Valley, where hundreds of hectares were cleared for the establishment of alfalfa crops to feed dairy and beef cattle (<http://www.vanguardia.com.mx/columnas-elhundido-1728357.html>). Another case



No. 9. *Phrynosoma orbiculare* (Linnaeus, 1758). The Mountain Horned Lizard is a Mexican endemic species that occurs “from eastern Sonora and western Chihuahua southward through the mountains of Durango, Zacatecas, Aguascalientes, Jalisco, and Michoacán, and from the mountains of southern Nuevo León southward through San Luis Potosí, Querétaro, Hidalgo, Veracruz, and westward through Puebla, Tlaxcala, Mexico, the Distrito Federal, and Morelos” (Lemos-Espinal and Dixon 2013: 122). Bryson et al. (2011) noted, however, that this species is probably comprised of several distinct lineages, of which some appear to have small distributions and long independent evolutionary histories, and that some of these lineages merit additional consideration for protection. This individual was found near Monterreal, in the municipality of Arteaga. Wilson et al. (2013a) calculated its EVS as 12, placing it in the upper half of the medium vulnerability category. Its conservation status has been reported as Least Concern by IUCN, and as threatened (A) by SEMARNAT. *Photo by Elí García-Padilla.*



No. 10. *Sceloporus cautilus* Smith, 1938. The Shy Spiny Lizard is an endemic Mexican lizard distributed from “the western slopes of the Sierra Madre Oriental in Tamaulipas, southeastern Coahuila, and central Nuevo León southward through much of San Luis Potosí and the northern half of Zacatecas” (Lemos-Espinal and Dixon 2013: 124). This individual was found at Cañon el Chorro, in the municipality of Arteaga. Wilson et al. (2013a) estimated its EVS as 15, placing it in the lower portion of the high vulnerability category. Its conservation status has been gauged as Least Concern by IUCN, but it is not listed by SEMARNAT. *Photo by Michael S. Price.*



No. 11. *Sceloporus olivaceus* Smith, 1934. The Texas Spiny Lizard is found from “northern central Texas southward through the Gulf of Mexico coastal plain to southern Tamaulipas, westward nearly to the Big Bend area of Texas and eastern Coahuila” (Lemos-Espinal et al. 2015: 239). This individual was encountered at Cañon el Chorro, in the municipality of Arteaga. Wilson et al. (2013a) calculated its EVS as 13, placing it at the upper limit of the medium vulnerability category. Its conservation status has been considered as Least Concern by IUCN; this species is not listed by SEMARNAT. *Photo by Michael S. Price.*



No. 12. *Sceloporus ornatus* Baird, 1859. The Ornate Spiny Lizard is a Mexican endemic species distributed in “southern and central Coahuila” (Lemos-Espinal and Smith 2007: 303). This individual was found at ca. 8 km SW from Ejido Mayrán, in the municipality of San Pedro. Wilson et al. (2013a) determined its EVS as 16, placing it in the middle portion of the high vulnerability category. Its conservation status has been calculated as Near Threatened by IUCN and as threatened (A) by SEMARNAT. *Photo by Marco Antonio Bazán-Tellez.*

involved members of the Mennonite community in Coahuila who were implicated in the clearing of 2,300 hectares of forest vegetation without authorization in the municipality of Sierra Mojada; however, they managed to escape legal sanction (<https://www.eluniversal.com.mx/estados/menonitas-de-coahuila-ganan-amparos-la-profepa-por-2-mil-hectareas-de-predios>).

Effect of roads. The state of Coahuila has an extensive network of roads and highways, with a total of seven federal highways. The total length of the road network in the state is 8,336 km (Servicio Geológico Mexicano 2017). During the period from 1980 to 2015, the number of motor vehicles traveling within Coahuila went from 149,242 to 741,515, an increase of 592,273 (or almost 400%!) in 35 years. The effect of roads on the herpetofauna of the state remains to be studied, but we assume that major highways might disrupt general dispersion patterns and seasonal migration of some local populations, and vehicles on municipal roads probably simply run over many animals in large numbers.

Mining and energy projects. The history of Coahuila is closely related to mining. It began as a leading commercial activity in the colonial era, with the founding of the city of Monclova and Minas de la Trinidad in 1577, and later continued with the discovery and exploitation of coal starting in 1828; copper in the Pánuco mine in 1870; zinc oxide, silver, and lead in Sierra Mojada in 1879; and silver, lead, and zinc in Reforma-Santa Teresa in 1890. Most recently, the discovery and exploitation of fluorite, celestite, sodium-magnesium salts, gypsum, barite, and dolomite has been undertaken. Coahuila has an extensive mining-metallurgical infrastructure, highlighted by the metal foundry in Torreón, the iron foundry in Monclova, coal plants in Nava, and several related processing plants in various locations. The state of Coahuila contributed 3.1% of the value of national mining production in 2015, occupying the first place in the production of iron, coal, celestite, magnesium sulfate, sodium sulfate, bismuth, and cadmium, second place in fluorite and silica, third in barite and dolomite, fifth in stone aggregates, and in smaller proportions plaster, sulfur, clays, gravel, sand, limestone, gold, and silver. In addition, a large number of unexplored geological areas have been reported in Coahuila (Servicio Geológico Mexicano 2017), for example, the Hercules mine in the northwestern portion of the state (<http://www.thediggings.com/mines/21966>; accessed 20 July 2019), and those places are expected to be sites for future development.

Natural gas production in the Burgos Basin. The Burgos Basin is a shale deposit located in the northeastern portion of Coahuila, directly south of the Rio Grande. It is considered a great prospect for natural gas production and covers a total area of 62,677 km². The infrastructure required to develop the production of natural gas is

scheduled to be built in a timely manner during successive 10-year periods, and involves extensive extraction, processing, and distribution facilities. It is expected that the previous and on-going infrastructure projects will have negative effects on the integrity of the habitat that is used by the members of the regional herpetofauna (<http://energiaadebate.com/gas-de-lutitas-en-la-cuenca-de-burgos/>).

Wind turbines. In 2016, a wind farm consisting of 95 wind turbines was being built near Ejido Hipólito in the Municipality of Ramos Arizpe, and another with 100 wind towers near Acuña, as well as a Solar Energy Park in the Municipality of Viesca, which will be the largest in Latin America and is planned to include more than two million solar panels (<http://coahuila.gob.mx/noticias/index/avanza-parque-eolico-de-hipolito-24-07-16>). The Ramos Arizpe project covers an area of 4,754 hectares. This requires, among other actions, the construction of more than 50 km of access roads, an aerial transmission line almost five km long, and an electrical substation (<http://proyectoecolico.coahuila.com>).

Elimination of herpetofauna due to cultural beliefs and practices. Traditional beliefs and practices that affect the herpetofauna of Coahuila are the same as those previously reported for Nuevo León (Nevárez-de los Reyes et al. 2016), likely due to their geographic proximity and similar cultural backgrounds. Examples include snakes being slaughtered due to fear and superstition, misconceptions that many non-venomous herpetofaunal species are venomous, and rattlesnakes being consumed either for food or the belief that their meat will prevent or cure cancer. It is obvious that education is the key for reducing the needless killing of these ecologically important denizens of Coahuila.

Use of pesticides. Agricultural activities in the state of Coahuila are most intense in the arid region known as Comarca Lagunera, where they are only possible due to heavy irrigation using water from the Río Nazas. Although there is little information regarding this problem, pesticides are commonly applied on Cantaloupe (*Cucumis melo*) fields, one of the most important fruits cultivated in the region (Vargas-González et al. 2016). That study found that in the agricultural cycle of 2010, 50 different active ingredients were used in the region; 26% of which were not authorized for use on cantaloupes by COFEPRIS, and 46% of which were considered as highly toxic to human health and the environment. For example, six of them (carbofuran, endosulfan, clorotalonil, mancozeb, imidacloprid, and metamidofos) are regarded as among the most toxic to humans and the environment.

Collecting and commercial trade. Currently, the herpetofauna of Coahuila faces problems with unlawful

collecting and commercial trade that are similar to those reported in Tamaulipas and Nuevo León (Terán-Juárez et al. 2016; Nevárez-de los Reyes et al. 2016). Unfortunately, these illegal activities have increased during the last few years through social media. For example, based on our personal observations, when photographs of rare species are posted, it is common for collectors to be immediately contacted by animal traffickers or pet owners ready to purchase their specimens, or asked for specific localities. Unfortunately, monitoring these activities remains difficult, as does determining their true impact on the local herpetofauna.

Fires involving natural habitats. Fires create a serious threat to natural habitats in Coahuila, especially those involving forested ecosystems. In 2017, 153 fires were documented in the state beginning on 2 January and ending on 23 December; thus, on average, a reported fire occurred somewhere in the state every 2.4 days. Of the 38 municipalities in Coahuila, fires were recorded in 22 (57.9%) of them. The municipalities most often involved were Arteaga (37 fires), Cuatro Ciénegas (12), Múzquiz (11), Ramos Arizpe (23), and Saltillo (24). Three of these municipalities (Arteaga, Ramos Arizpe, and Saltillo) are located in the extreme southeastern portion of the state where the state capital is located and where a majority of the fires have occurred (84 of 153 fires, or 54.9%). The number of ha involved in each of these 153 fires ranged from 0.02 to 3,132. The largest of these fires took place in the Municipality of San Buenaventura, at a locality called, interestingly enough, El Quemado (“burned by fire”). The total area burned in 2017 amounted to 10,289.6 ha, which is approximately 0.07% the total area of Coahuila (15,159,500 ha).

At the time of this writing, information is also available for the first 4.5 months of 2018 (10 January to 13 May) (CONAFOR, Comisión Nacional Forestal Aspectos de Incendios Forestales, <https://www.gob.mx/conafor>). During this period of time, 46 fires were reported, or one fire in Coahuila every 2.9 days. Fires were registered in 14 of the 38 municipalities in the state (36.8%). These fires occurred most often in the Municipalities of Múzquiz (15 fires), Cuatro Ciénegas (four), Arteaga (three), Nadadores (three), Ocampo (three), and Saltillo (three). Four of these six municipalities (Múzquiz, Cuatro Ciénegas, Arteaga, and Saltillo) represent areas with high fire occurrences during 2017 (see above). The number of hectares burned in each fire during this 2018 period varied from 0.5 to 1,500. The largest fire took place in Eutimias, in the Municipality of Ocampo, due to lightning strikes. In general, the principal causes of these fires, when known, were human negligence and lightning. During this period, the total area burned was 4,198.3 ha (about 0.03% of the state, or 31.3 ha/ day). This figure compares to 28.2 ha/day in 2017. It appears likely that the total number of hectares burned in Coahuila in 2018 should compare to those burned in 2017 (see above). The

threat posed by fires will almost assuredly increase into the future, given the human population growth in the state of 7.5% from 2010 to 2015, which is higher than the rate in Mexico as a whole (6.8%; <http://wikipedia.org>; accessed 5 July 2018).

Lazcano et al. (2006) reported finding a Wiegmann’s Alligator Lizard (*Gerrhonotus liocephalus*) killed by a forest fire in the neighboring state of Nuevo León and advised that only additional investigations would be able to determine the demographic consequences of this sort of mortality. Banda-Leal et al. (2018) documented for the first time the distribution of *Gerrhonotus parvus* in Coahuila, and mentioned finding some specimens of this species in the Sierra Zapalinamé that had died from forest fires.

Conservation Status

The discussion of the conservation status of members of the Coahuilan herpetofauna follows the same three systems of conservation assessment as used in the other entries in the Mexican Conservation Series. These systems are those found in SEMARNAT (2010), the IUCN Red List (<http://iucnredlist.org>), and the EVS (Wilson et al. 2013a,b). The assessments from these three systems were updated as needed.

The SEMARNAT System. SEMARNAT (Secretaría del Medio Ambiente y Recursos Naturales) is the environmental ministry of Mexico, and it is “*charged with the mission of protecting, restoring, and conserving the ecosystems, natural resources, assets and environmental services of Mexico with the goal of fostering sustainable development*” (<http://www.semarnat.gob.mx/conocenos/quienessomos>; accessed 7 January 2019). In 2010, this agency published the Norma Oficial Mexicana (Official Mexican Standard)-059, which deals with the protection of the native members of the Mexican flora and fauna and establishes categories of risk. This system is commonly used by Mexican herpetologists to discuss various segments of the country’s herpetofauna. Its utility for work on the herpetofauna of Coahuila has also been assessed. The SEMARNAT system comprises three categories, including Endangered (P), Threatened (A), and Special Protection (Pr). For a Mexican species not evaluated using one of these three categories, it is designated here as having no status (NS). The SEMARNAT evaluations are shown in Table 7 and summarized in Table 9.

Unfortunately, the SEMARNAT assessments are not very useful here, as most species in Coahuila remain unevaluated (90 of 140 native species; 64.3%). Thus, evaluations of conservation status are available for only 50 species (35.7%). Of these 50 species, 23 (46.0% of the total) are judged as species of Special Protection (Pr): *Anaxyrus debilis*, *Gastrophryne olivacea*, *Lithobates berlandieri*, *Ambystoma velasci**, *Aquiloerycea scandens**, *Chiropterotriton priscus**, *Gerrhonotus*



Fig. 17. *Deforestation for Ranching Purposes.* Goats in the vicinity of Estación Marte, in the municipality of General Cepeda. *Photo by Manuel Nevárez de los Reyes.*



Fig. 18. *Deforestation for Ranching Purposes.* Cattle in the municipality of Francisco I. Madero. *Photo by Manuel Nevárez de los Reyes.*



Fig. 19. *Impact of Roads.* *Masticophis flagellum* dead on the road near El Mimbres, in the municipality of Parras. *Photo by Manuel Nevárez de los Reyes.*



Fig. 20. *Mining Projects.* Mineral charcoal mining exploitation, in the municipality of Nava. *Photo by Manuel Nevárez de los Reyes.*



Fig. 21. *Mining Projects.* Mining of materials for construction near Paso de Carneros, in the municipality of Saltillo. *Photo by Manuel Nevárez de los Reyes.*



Fig. 22. *Energy Projects.* Wind generation of electricity near Hipolito, in the municipality of Ramos Arizpe. *Photo by Manuel Nevárez de los Reyes.*

parvus, *Gambelia wislizenii*, *Coleonyx brevis*, *Coleonyx reticulatus*, *Sceloporus grammicus*, *S. maculosus**, *Scincella lateralis*, *Crotalus atrox*, *C. lepidus*, *C. molossus*, *C. pricei*, *C. scutulatus*, *C. viridis*, *Sistrurus tergeminus*, *Terrapene ornata*, *Kinosternon hirtipes*, and *Apalone spinifera*. These 23 species include four that are endemic to Mexico (indicated by asterisks); and all of the 19 non-endemic species are shared with the United States. The

remaining 27 species are assessed as either Endangered (P) or Threatened (A). The Endangered species amount to four: *Uma exsul*, *U. paraphygae*, *Gopherus flavomarginatus*, and *Apalone atra* (Table 7); three are endemic to Coahuila and one is endemic to Mexico. Twenty-three species are considered as Threatened: *Aquiloeurycea galeanae*, *Crotaphytus collaris*, *C. reticulatus*, *Cophosaurus texanus*, *Holbrookia lacerata*,

Table 9. SEMARNAT categorizations for herpetofaunal species in Coahuila, Mexico, arranged by families. Non-native species are not included.

Families	Number of species	SEMARNAT Categorizations			
		Endangered (P)	Threatened (A)	Special protection (Pr)	No status (NS)
Bufonidae	7	—	—	1	6
Craugastoridae	1	—	—	—	1
Eleutherodactylidae	3	—	—	—	3
Hylidae	4	—	—	—	4
Microhylidae	1	—	—	1	—
Ranidae	1	—	—	1	—
Scaphiopodidae	2	—	—	—	2
Subtotals	19	—	—	3	16
Ambystomatidae	1	—	—	1	—
Plethodontidae	3	—	1	2	—
Subtotals	4	—	1	3	—
Totals	23	—	1	6	16
Anguidae	5	—	—	1	4
Crotaphytidae	4	—	2	1	1
Eublepharidae	2	—	—	2	—
Phrynosomatidae	29	2	5	2	20
Scincidae	3	—	—	—	3
Sphenomorphidae	3	—	1	1	1
Teiidae	4	—	—	—	4
Xantusiidae	1	—	—	—	1
Subtotals	51	2	8	7	34
Colubridae	29	—	7	—	22
Dipsadidae	4	—	—	—	4
Elapidae	1	—	—	—	1
Leptotyphlopidae	3	—	—	—	3
Natricidae	7	—	4	—	3
Viperidae	10	—	—	7	3
Subtotals	54	—	11	7	36
Emydidae	5	—	2	1	2
Kinosternidae	3	—	—	1	2
Testudinidae	2	1	1	—	—
Trionychidae	2	1	—	1	—
Subtotals	12	2	3	3	4
Totals	117	4	22	17	74
Sum Totals	140	4	23	23	90

Phrynosoma orbiculare, *Sceloporus ornatus*, *Uta stansburiana*, *Scincella silvicola*, *Coluber constrictor*, *Lampropeltis alterna*, *Masticophis flagellum*, *Pituophis deppei*, *Tantilla atriceps*, *T. gracilis*, *Trimorphodon wilkinsonii*, *Nerodia erythrogaster*, *Thamnophis exsul*, *T. marcianus*, *T. proximus*, *Pseudemys gorzugi*, *Terrapene coahuila*, and *Gopherus berlandieri*. This group of 23 species includes a curious mixture of seven country and state endemic species and 16 relatively broadly ranging non-endemic species, some with extensive ranges in the United States.

Until such time as SEMARNAT provides conservation evaluations for all Mexican herpetofaunal species, this system will continue to have only limited utility for conservation purposes.

The IUCN System. The system of conservation categorization developed by the International Union for the Conservation of Nature (IUCN) is applied globally, theoretically to all organisms, and consists of a set of nine categories, divided into four general categories, including: Extinct (Extinct and Extinct in the Wild), Threatened (Critically Endangered, Endangered, and Vulnerable), Lower Risk (Near Threatened and Least Concern), and other categories (Data Deficient and Not Evaluated). Those evaluations applying to the Coahuilan herpetofauna are shown in Table 7 and summarized in Table 10.

Only 14 of 140 native species (10.0%) are judged to be Threatened. No species are considered to be Critically Endangered; seven are assessed as Endangered; and seven

Table 10. IUCN Red List categorizations for herpetofaunal families in Coahuila, Mexico. Non-native species are excluded. The shaded columns to the left are the “threat categories,” and those to the right are the categories for which either too little information on conservation status exists to allow the taxa to be placed in any IUCN category, or they have not been evaluated.

Families	Number of Species	IUCN Red List categorizations						
		Critically Endangered	Endangered	Vulnerable	Near Threatened	Least Concern	Data Deficient	Not Evaluated
Bufonidae	7	—	—	—	—	7	—	—
Craugastoridae	1	—	—	—	—	1	—	—
Eleutherodactylidae	3	—	—	1	—	2	—	—
Hylidae	4	—	—	—	1	2	—	1
Microhylidae	1	—	—	—	—	1	—	—
Ranidae	1	—	—	—	—	1	—	—
Scaphiopodidae	2	—	—	—	—	2	—	—
Subtotals	19	—	—	1	1	16	—	1
Ambystomatidae	1	—	—	—	—	1	—	—
Plethodontidae	3	—	—	1	2	—	—	—
Subtotals	4	—	—	1	2	1	—	—
Totals	23	—	—	2	3	17	—	1
Anguidae	5	—	1	—	—	2	—	2
Crotaphytidae	4	—	1	1	—	2	—	—
Eublepharidae	2	—	—	—	—	2	—	—
Phrynosomatidae	29	—	3	1	3	17	—	5
Scincidae	3	—	—	—	—	2	—	1
Sphenomorphidae	3	—	—	—	—	2	—	1
Teiidae	4	—	—	—	—	3	—	1
Xantusiidae	1	—	—	—	—	1	—	—
Subtotals	51	—	5	2	3	31	—	10
Colubridae	29	—	—	—	—	23	—	6
Dipsadidae	4	—	—	—	—	1	—	3
Elapidae	1	—	—	—	—	1	—	—
Leptotyphlopidae	3	—	—	—	—	2	—	1
Natricidae	7	—	—	1	—	6	—	—
Viperidae	10	—	—	—	—	8	—	2
Subtotals	54	—	—	1	—	42	—	11
Emydidae	5	—	2	1	2	—	—	—
Kinosternidae	3	—	—	—	—	2	1	—
Testudinidae	2	—	—	1	—	1	—	—
Trionychidae	2	—	—	—	—	1	—	1
Subtotals	12	—	2	2	2	4	1	1
Totals	117	—	7	5	5	77	1	23
Sum Totals	140	—	7	7	8	94	1	23
Category Totals	140	14			102		24	

others as Vulnerable. The seven Endangered species are: *Gerrhonotus parvus**, *Crotaphytus antiquus***, *Sceloporus cyanostictus**, *S. goldmani**, *Uma exsul***, *Terrapene coahuila***, and *Trachemys taylori***. Three of these species are country endemics and four are state endemics. The seven Vulnerable species (VU) are: *Eleutherodactylus longipes**, *Aquiloerycea scandens**, *Crotaphytus reticulatus*, *Sceloporus maculosus**, *Storeria hidalgoensis**, *Trachemys gaigeae*, and *Gopherus flavomarginatus**. Five of the seven VU species are country endemics; the remainder are non-endemics. The Lower Risk species amount to 102 species, constituting 72.9% of the native species in the state (Table 10). Of these 102 species, eight are Near Threatened and 94

are Least Concern. As has been demonstrated clearly in other studies in the Mexican Conservation Series, the allocation of such a large number of species to the Least Concern category seems unjustified and the conservation status of these 94 “Least Concern” species is examined in greater detail in the following section.

Only a single Coahuilan species is considered to be Data Deficient (Table 10): *Kinosternon durangoense* (Table 7). This turtle is a country endemic that was recognized as a distinct species in 2001 (Serb et al. 2001) by being elevated from a subspecies of *K. flavescens*, but very little information on its biology and conservation status is available to date. Therefore, this appears to be a sound assessment.



No. 13. *Sceloporus samcolemani* Smith and Hall, 1974. Coleman's Bunch Grass Lizard is a Mexican endemic species that ranges from "extreme southeastern Coahuila and southern central Nuevo León" (Watkins-Colwell et al. 1998: 675.2). This individual was seen at Monterreal, in the municipality of Arteaga. Wilson et al. (2013a) gauged its EVS as 15, placing it in the lower portion of the high vulnerability category. Its conservation status has been determined as Least Concern, but this lizard is not listed by SEMARNAT. *Photo by Michael S. Price.*



No. 14. *Uma exsul* Schmidt and Bogert (1947). The Fringe-toed Sand Lizard is a Mexican endemic species occurring in extreme southwestern and south-central Coahuila (Lemos-Espinal and Smith 2007). This individual was located at ca. 2 km SW from Ejido Alejandria, in the municipality of San Pedro. Wilson et al. (2013a) assessed its EVS as 16, placing it in the middle portion of the high vulnerability category. Its conservation status is evaluated as Endangered by IUCN and as endangered (P) by SEMARNAT. *Photo by Marco Antonio Bazán-Tellez.*



No. 15. *Plestiodon dicei* (Ruthven and Gaige, 1933). Dice's Short-nosed Skink is a Mexican endemic occurring from central Nuevo León eastward to central and southern Tamaulipas (Feria-Ortiz et al. 2011). This individual was found in Monterreal, in the municipality of Arteaga. Wilson et al. (2013a) calculated its EVS as 12, placing it in the upper portion of the medium vulnerability category. Its conservation status has not been evaluated by IUCN and this species is not listed by SEMARNAT. *Photo by Elí García Padilla.*



No. 16. *Bogertophis subocularis* (Brown, 1901). The Trans-Pecos Rat Snake is distributed “in southern New Mexico, southwestern Texas, and in northeastern Mexico, from Chihuahua through Coahuila and into Nuevo León and through Durango down to its border with Zacatecas” (Lemos-Espinal et al. 2015: 318). This individual came from Cuatrociénegas, in the municipality of Cuatrociénegas de Carranza. Wilson et al. (2013a) judged its EVS as 14, placing it at the lower edge of the high vulnerability category. Its conservation status is evaluated as Least Concern by IUCN, but it is not listed by SEMARNAT. *Photo by Michael S. Price.*

Twenty-three species (16.4%) in the native Coahuilan herpetofauna remain unevaluated (Table 10). The status of these species is examined further using the EVS system in the following section.

The EVS System. The EVS system, developed originally for use in the conservation assessment of the Honduran herpetofauna (Wilson and McCranie 2004), has been applied subsequently to the entirety of Mexico (Wilson et al. 2013a,b) and to Central America (Johnson et al. 2015b), as well as to various states and groups of states in Mexico (Alvarado-Díaz et al. 2013; Mata-Silva et al. 2015; Johnson et al. 2015a; Terán-Juárez et al. 2016; Woolrich-Piña et al. 2016, 2017; Nevárez-de los Reyes et al. 2016; Cruz-Sáenz et al. 2017; González-Sánchez et al. 2017). Wilson et al. (2013a,b) described the use of this system for the herpetofauna of Mexico; and it is employed here to assess the conservation status of the herpetofauna of Coahuila (see data in Table 7, summarized in Table 11).

The total range of EVS values for the herpetofauna of Coahuila spans the entire theoretical EVS range (3–20). The most frequent values (more than 10 species) are nine (10), 10 (10), 11 (12), 12 (17), 13 (17), 14 (14), 15 (13), and 16 (12). These eight scores were applied to a total of 104 species, or 74.3% of the total number of native species. The average EVS value is 12.1 (1,693/140). When allocated to the three summary categories of low (3–9), medium (10–13), and high (14–20), the species counts for these categories are 32, 56, and 52, respectively.

The lowest EVS value of 3 was applied to three species of anurans (*Rhinella horribilis*, *Smilisca baudinii*, and *Scaphiopus couchii*), which are geographically and ecologically widespread and have the most widespread reproductive mode (eggs and tadpoles in still water). At the other extreme, one species (the trionychid turtle *Apalone atra*) was provided a value of 20, because of its narrow geographic and ecological distribution and its high level of human persecution.

Comparing the results of the IUCN categorization with those of the EVS system in Table 12, indicates that 14 of the 52 high vulnerability species (26.9%) are judged to occupy one of two IUCN threat categories (EN or VU, note that no species are allocated to the CR category). Seven species (five lizards and two turtles) are evaluated as EN, and seven as VU (one anuran, one salamander, two lizards, one snake, and two turtles). These 14 species comprise 10.0% of the 140 native herpetofaunal species in Coahuila. At the opposite extreme, the 32 low vulnerability species comprise 35.1% of the 93 LC species. As in other Mexican Conservation Series studies, the results of the applications of the IUCN and EVS systems do not complement one another.

Twenty-four species remain unassessed using the IUCN system (allocated to the NE category in Table 7). Four of these species are state endemics (*Gerrhonotus mccoysi*, *Sceloporus gadsdeni*, *Scincella kikaapoa*,

and *Apalone atra*), five are country endemics (*Barisia imbricata*, *Holbrookia approximans*, *Plestiodon dicei*, *Lampropeltis leonis*, and *Crotalus morulus*), and the remainder are non-endemics. The range of EVS values for these 24 species is 6–20, which places some of them into each of the three summary categories (Table 13). Four have low EVS scores, ten have medium scores, and ten have high scores. Until such time as IUCN evaluations are available for these species, we suggest that the high EVS species should be placed in one of the three threat categories, perhaps as follows: CR—*Gerrhonotus mccoysi*, *Sceloporus gadsdeni*, *Scincella kikaapoa*, *Lampropeltis leonis*, *Crotalus morulus*, *Apalone atra*; EN—*Barisia imbricata*, *Holbrookia approximans*; VU—*Aspidoscelis marmorata*, *Salvadora deserticola*. We also suggest that the species with EVS of 12 or 13 be placed in the NT category. The remainder of the species with EVS of 6–11 can be allocated to the LC category (Table 13).

As with other studies in the Mexican Conservation Series, this study found that a significantly large number of the Coahuilan herpetofauna members have been allocated by the IUCN to the Least Concern category. The number of such species amounts to 93 (66.4% of the total of 140 species). Given that almost seven of every ten herpetofaunal species in Coahuila is judged Least Concern, it might appear that the state herpetofauna is in relatively good shape with respect to conservation status. In order to ascertain whether such an optimistic view is the case, the 93 species in Table 14 were placed along with the calculations for their respective EVS values. Although one might expect that the LC species would most likely be non-endemic to Mexico, this analysis found that 12 are country endemics, including one salamander, nine lizards, and two snakes, and one lizard is a state endemic (Table 14). The range of EVS values for these 93 species is 3–18, or only slightly less than the entire theoretical range for EVS (3–20). The allocation of the EVS values for the 93 species into the three summary categories demonstrates the following: low (3–9)—27; medium (10–13)—45; and high (14–20)—22. Based on these allocations, we suggest that a more realistic assessment would place the 22 high vulnerability species in one of the three IUCN threat categories, as follows: CR (*Gerrhonotus lugoi*, *Thamnophis exsul*, and *Gopherus berlandieri*); EN (*Coleonyx reticulatus*, *Sceloporus cautus*, *S. couchii*, *S. parvus*, *S. samcolemani*, *Xantusia extorris*, *Lampropeltis mexicana*, *Pantherophis bairdi*, and *Apalone spinifera*); and VU (*Coleonyx brevis*, *Cophosaurus texanus*, *Sceloporus minor*, *Aspidoscelis inornata*, *A. tessellata*, *Bogertophis subocularis*, *Lampropeltis alterna*, *Pituophis deppei*, *Agkistrodon laticinctus*, and *Crotalus pricei*). We also suggest that the 43 medium vulnerability species probably should be placed in the NT category, and that the 27 low vulnerability species could remain in the LC category.

Table 11. Environmental Vulnerability Scores (EVS) for herpetofaunal species in Coahuila, Mexico, arranged by family. Shaded area to the left encompasses low vulnerability scores, and the one to the right high vulnerability scores. Non-native species are excluded.

Families	Number of Species	Environmental Vulnerability Scores																		
		3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
Bufonidae	7	1	—	1	1	1	—	1	1	—	1	—	—	—	—	—	—	—	—	
Craugastoridae	1	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	
Eleutherodactylidae	3	—	—	—	—	—	—	—	—	1	1	—	—	1	—	—	—	—	—	
Hylidae	4	1	—	—	—	1	—	1	—	—	1	—	—	—	—	—	—	—	—	
Microhylidae	1	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	
Ranidae	1	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	
Scaphiopodidae	2	1	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Subtotals	19	3	—	1	2	3	1	3	1	1	3	—	—	1	—	—	—	—	—	
Ambystomatidae	1	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	
Plethodontidae	3	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1	—	—	—	
Subtotals	4	—	—	—	—	—	—	—	1	—	—	—	—	—	1	1	—	—	—	
Totals	23	3	—	1	2	3	1	3	2	1	3	—	—	1	1	1	1	—	—	
Anguidae	5	—	—	—	—	—	—	—	—	—	—	1	—	1	1	2	—	—	—	
Crotaphytidae	4	—	—	—	—	—	—	—	—	—	1	2	—	—	1	—	—	—	—	
Eublepharidae	2	—	—	—	—	—	—	—	—	—	—	—	1	1	—	—	—	—	—	
Phrynosomatidae	29	—	—	—	—	1	—	2	1	2	4	4	4	5	4	2	—	—	—	
Scincidae	3	—	—	—	—	—	—	—	—	1	2	—	—	—	—	—	—	—	—	
Sphenomorphidae	3	—	—	—	—	—	—	—	—	—	1	1	—	—	—	1	—	—	—	
Teiidae	4	—	—	—	—	—	—	1	—	—	—	—	3	—	—	—	—	—	—	
Xantusiidae	1	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	
Subtotals	51	—	—	—	—	1	—	3	1	3	8	8	8	8	6	5	—	—	—	
Colubridae	29	—	—	1	1	—	2	3	4	3	3	5	4	2	1	—	—	—	—	
Dipsadidae	4	—	1	—	1	—	1	—	—	1	—	—	—	—	—	—	—	—	—	
Elapidae	1	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	
Leptotyphlopidae	3	—	—	—	—	—	1	—	—	1	—	1	—	—	—	—	—	—	—	
Natricidae	7	—	—	—	—	2	—	—	2	1	—	1	—	—	1	—	—	—	—	
Viperidae	10	—	—	—	—	—	1	1	—	1	2	2	2	—	1	—	—	—	—	
Subtotals	54	—	1	1	2	2	5	4	6	8	5	9	6	2	3	—	—	—	—	
Emydidae	5	—	—	—	—	—	—	—	—	—	—	—	—	1	1	—	1	2	—	
Kinosternidae	3	—	—	—	—	—	—	—	1	—	1	—	—	—	1	—	—	—	—	
Testudinidae	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1	—	
Trionychidae	2	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	1	
Subtotals	12	—	—	—	—	—	—	—	1	—	1	—	—	2	2	—	2	3	1	
Totals	117	—	1	2	2	3	5	7	8	11	14	17	14	12	11	5	2	3	1	
Sum Totals	140	3	1	2	4	6	6	10	10	12	17	17	14	13	12	6	3	3	1	
Category Totals	140	32						56						52						

Table 12. Comparison of Environmental Vulnerability Scores (EVS) and applicable IUCN categorizations for members of the herpetofauna of Coahuila, Mexico. Non-native species are excluded. No species are allocated to the CR IUCN categories. Shaded area at the top encompasses low vulnerability category scores, and the one at the bottom high vulnerability category scores.

EVS	IUCN Categories						Total
	Endangered	Vulnerable	Near Threatened	Least Concern	Data Deficient	Not Evaluated	
3	—	—	—	3	—	—	3
4	—	—	—	1	—	—	1
5	—	—	—	2	—	—	2
6	—	—	—	3	—	1	4
7	—	—	—	6	—	—	6
8	—	—	—	4	—	2	6
9	—	—	1	8	—	1	10
10	—	—	—	10	—	—	10
11	—	—	—	10	—	2	12
12	—	1	—	12	—	4	17
13	—	1	—	12	—	4	17
14	—	—	1	10	—	3	14
15	1	1	1	9	—	1	13
16	3	1	3	2	1	2	12
17	1	1	1	—	—	3	6
18	—	1	1	1	—	—	3
19	2	1	—	—	—	—	3
20		—	—	—	—	1	1
Totals	7	7	8	93	1	24	140

Table 13. Environmental Vulnerability Scores (EVS) for members of the herpetofauna of Coahuila, Mexico, currently not evaluated (NE) by the IUCN. Non-native taxa are not included. * = country endemic species; ** = state endemic species.

Taxa	Environmental Vulnerability Score			
	Geographic Distribution	Ecological Distribution	Reproductive Mode/Degree of Persecution	Total Score
<i>Acris blanchardi</i>	3	8	1	12
<i>Barisia ciliaris</i> *	5	7	3	15
<i>Gerrhonotus mccoysi</i> **	6	8	3	17
<i>Holbrookia approximans</i> *	5	6	3	14
<i>Sceloporus cowlesi</i>	4	6	3	13
<i>Sceloporus cyanogenys</i>	4	6	3	13
<i>Sceloporus gadsdeni</i> **	6	8	3	17
<i>Sceloporus marmoratus</i>	2	6	3	11
<i>Plestiodon dicei</i> *	5	4	3	12
<i>Scincella kikaapoa</i> **	6	8	3	17
<i>Aspidoscelis marmorata</i>	4	7	3	14
<i>Lampropeltis annulata</i>	4	3	5	12
<i>Lampropeltis gentilis</i>	3	1	5	9
<i>Lampropeltis leonis</i> *	5	6	5	16
<i>Lampropeltis splendida</i>	4	5	3	12
<i>Salvadora deserticola</i>	4	6	4	14
<i>Sonora episcopa</i>	3	7	3	13
<i>Heterodon kennerlyi</i>	3	4	4	11
<i>Hypsiglena jani</i>	1	3	2	6
<i>Leptodeira septentrionalis</i>	2	2	4	8
<i>Rena segrega</i>	4	3	1	8
<i>Crotalus morulus</i>	5	6	5	16
<i>Crotalus ornatus</i>	4	4	5	13
<i>Apalone atra</i> **	6	8	6	20

Table 14. Environmental Vulnerability Scores (EVS) for members of the herpetofauna of Coahuila, Mexico, assigned to the IUCN Least Concern category. Non-native taxa are not included. * = country endemic species; ** = state endemic species.

Taxa	Environmental Vulnerability Score			
	Geographic Distribution	Ecological Distribution	Reproductive Mode/Degree of Persecution	Total Score
<i>Anaxyrus cognatus</i>	3	5	1	9
<i>Anaxyrus debilis</i>	1	5	1	7
<i>Anaxyrus punctatus</i>	1	3	1	5
<i>Anaxyrus speciosus</i>	4	7	1	12
<i>Anaxyrus woodhousii</i>	3	6	1	10
<i>Incilius nebulifer</i>	1	4	1	6
<i>Rhinella horribilis</i>	1	1	1	3
<i>Craugastor augusti</i>	2	2	4	8
<i>Eleutherodactylus cystignathoides</i>	2	6	4	12
<i>Eleutherodactylus guttilatus</i>	2	5	4	11
<i>Dryophytes arenicolor</i>	2	4	1	7
<i>Smilisca baudinii</i>	1	1	1	3
<i>Gastrophryne olivacea</i>	3	5	1	9
<i>Lithobates berlandieri</i>	4	2	1	7
<i>Scaphiopus couchii</i>	1	1	1	3
<i>Spea multiplicata</i>	1	4	1	6
<i>Ambystoma velasci</i> *	5	4	1	10
<i>Gerrhonotus infernalis</i>	5	5	3	13
<i>Gerrhonotus lugoi</i> **	5	8	3	16
<i>Crotaphytus collaris</i>	3	7	3	13
<i>Crotaphytus wislizenii</i>	3	7	3	13
<i>Coleonyx brevis</i>	4	6	4	14
<i>Coleonyx reticulatus</i>	4	7	4	15
<i>Cophosaurus texanus</i>	4	7	3	14
<i>Phrynosoma cornutum</i>	1	7	3	11
<i>Phrynosoma modestum</i>	4	5	3	12
<i>Phrynosoma orbiculare</i> *	5	4	3	12
<i>Sceloporus cautus</i> *	5	7	3	15
<i>Sceloporus couchii</i> *	5	7	3	15
<i>Sceloporus grammicus</i>	2	4	3	9
<i>Sceloporus magister</i>	1	5	3	9
<i>Sceloporus merriami</i>	4	6	3	13
<i>Sceloporus minor</i> *	5	6	3	14
<i>Sceloporus olivaceus</i>	4	6	3	13
<i>Sceloporus parvus</i> *	5	7	3	15
<i>Sceloporus poinsettii</i>	4	5	3	12
<i>Sceloporus samcolemani</i> *	5	7	3	15
<i>Sceloporus spinosus</i> *	5	4	3	12
<i>Urosaurus ornatus</i>	2	5	3	10
<i>Uta stansburiana</i>	3	1	3	7
<i>Plestiodon obsoletus</i>	3	5	3	11
<i>Plestiodon tetragrammus</i>	4	5	3	12
<i>Scincella lateralis</i>	3	7	3	13
<i>Scincella silvicola</i> *	5	4	3	12
<i>Aspidoscelis gularis</i>	2	4	3	9
<i>Aspidoscelis inornata</i>	4	7	3	14
<i>Aspidoscelis tessellata</i>	4	7	3	14
<i>Xantusia extorris</i> *	5	7	3	15
<i>Arizona elegans</i>	1	1	3	5
<i>Bogertophis subocularis</i>	4	7	3	14
<i>Coluber constrictor</i>	1	6	3	10

Table 14 (continued). Environmental Vulnerability Scores (EVS) for members of the herpetofauna of Coahuila, Mexico, assigned to the IUCN Least Concern category. Non-native taxa are not included. * = country endemic species; ** = state endemic species.

Taxa	Environmental Vulnerability Score			
	Geographic Distribution	Ecological Distribution	Reproductive Mode/Degree of Persecution	Total Score
<i>Gyalopion canum</i>	4	3	2	9
<i>Lampropeltis alterna</i>	4	7	3	14
<i>Masticophis flagellum</i>	1	3	4	8
<i>Masticophis schotti</i>	4	5	4	13
<i>Masticophis taeniatus</i>	1	5	4	10
<i>Opheodrys aestivus</i>	3	7	3	13
<i>Pantherophis bairdi</i>	4	7	4	15
<i>Pantherophis emoryi</i>	3	6	4	13
<i>Pituophis catenifer</i>	4	1	4	9
<i>Pituophis deppei</i> *	5	5	4	14
<i>Rhinocheilus lecontei</i>	1	3	4	8
<i>Salvadora grahamiae</i>	4	2	4	10
<i>Tantilla atriceps</i>	2	7	2	11
<i>Tantilla cucullata</i>	4	6	2	12
<i>Tantilla gracilis</i>	3	8	2	13
<i>Tantilla hobartsmithi</i>	3	6	2	11
<i>Tantilla nigriceps</i>	3	6	2	11
<i>Tantilla wilcoxi</i>	2	6	2	10
<i>Trimorphodon wilkinsonii</i>	4	7	4	15
<i>Diadophis punctatus</i>	1	1	2	4
<i>Micrurus tener</i>	1	5	5	11
<i>Rena dissecta</i>	4	6	1	11
<i>Rena dulcis</i>	4	8	1	13
<i>Nerodia erythrogaster</i>	3	4	4	11
<i>Nerodia rhombifer</i>	1	5	4	10
<i>Thamnophis cyrtopsis</i>	2	1	4	7
<i>Thamnophis exsul</i> *	5	7	4	16
<i>Thamnophis marcianus</i>	1	5	4	10
<i>Thamnophis proximus</i>	1	2	4	7
<i>Agkistrodon contortrix</i>	3	6	5	14
<i>Crotalus atrox</i>	1	3	5	9
<i>Crotalus lepidus</i>	2	5	5	12
<i>Crotalus molossus</i>	2	1	5	8
<i>Crotalus pricei</i>	2	7	5	14
<i>Crotalus scutulatus</i>	2	4	5	11
<i>Crotalus viridis</i>	1	6	5	12
<i>Sistrurus tergeminus</i>	3	5	5	13
<i>Kinosternon flavescens</i>	3	6	3	12
<i>Kinosternon hirtipes</i>	2	5	3	10
<i>Gopherus berlandieri</i>	4	8	6	18
<i>Apalone spinifera</i>	3	6	6	15

Relative Herpetofaunal Priority

Johnson et al. (2015a) developed the concept of Relative Herpetofaunal Priority (RHP), a simple means for measuring the relative importance of the herpetofaunal species found in any geographic entity (e.g., a state or a physiographic region). Determining the RHP involves the use of two methods, i.e., (1) calculating the proportion

of state and country endemics relative to the entire physiographic regional herpetofauna, and (2) computing the absolute number of EVS high category species in each physiographic regional herpetofauna. Here, two tables have been constructed to ascertain the RHP values for the Coahuilan herpetofauna, one for the endemicity values (Table 15) and the other for the high category EVS values (Table 16). The data in Table

Table 15. Numbers of herpetofaunal species in four distributional categories among the 10 physiographic provinces of Coahuila, Mexico. Rank determined by adding state and country endemics.

Physiographic Province	Non-endemics	Country endemics	State endemics	Non-natives	Total	Rank Order
Bolsón de Mapimi	36	5	2	2	45	4
Llanuras y Sierras Volcánicas	42	1	—	1	44	7
Laguna de Mayrán	35	1	1	1	38	6
Sierras y Llanuras Coahuilenses	80	3	5	3	91	3
Serranía del Burro	43	1	—	1	45	7
Sierra de la Paila	37	2	—	1	40	6
Pliegues Saltillo Parras	41	6	—	2	49	5
Sierras Transversales	32	13	—	1	46	2
Gran Sierra Plegada	32	18	—	1	51	1
Llanuras de Coahuila y Nuevo León	50	—	1	2	53	7

15 demonstrate that the highest amount of endemism is found in the Gran Sierra Plegada, only a small portion of which is located in Coahuila (Fig. 1); thus, this region occupies rank number 1 using this measure. Of the 51 species recorded in this region, 18 are country endemics (35.3%). Nevárez-de los Reyes et al. (2016) found a similar situation prevailing in the neighboring state of Nuevo León, in which 33 of 87 species (37.9%) in this same region consist of country and state endemics. Rank number 2 is occupied by the Sierras Transversales located along the southern border of Coahuila, in which 13 of 46 species (28.3%) are country endemics. The remaining eight physiographic regions occupy ranks 3 through 7, given that several of these regions share the same rank with other regions (Table 15). One region (Sierras y Llanuras Coahuilenses) occupies rank 3, and contains eight country and state endemics. Only one region occupies rank 4, which is the Bolsón de Mapimí, with five country endemics and two state endemics. One region (Pliegues Saltillo Parras) lies at rank 5, with six country endemics. Two regions (Laguna de Mayrán and Sierra de la Paila) occupy rank 6, with two endemics each. Finally, there are three regions (Llanuras y Sierras Volcánicas, Serranías del Burro, and Llanuras de Coahuila y Nuevo León) that occupy rank 7, each with a single endemic species.

The numbers of species for each of the 10 physiographic regions are placed into the three EVS

categories (low, medium, and high) in Table 16. These data indicate that the greatest number of high vulnerability species (22 of 88, 25.0%) is found in the Sierras y Llanuras Coahuilenses in the central portion of the state (Fig. 1), thus this region occupies rank number 1. The next highest number (17 of 50 species, or 34.0%) is found in the Gran Sierra Plegada, which is located in the southeastern corner of the state (Fig. 1) and occupies rank number 2. The 3rd rank is occupied by the Sierras Transversales, with 14 high-vulnerability species out of 46 (30.4%). The numbers of high EVS species in the remaining seven regions range from seven to 13.

The rankings obtained by using these two RHP methods are not identical, but at least the regions occupying ranks 1 through 3 are the same three regions in each case, as follows (endemic species ranking followed by high vulnerability ranking):

- Gran Sierra Plegada (1, 2)
- Sierras Transversales (2, 3)
- Sierras y Llanuras Coahuilenses (3, 1)

The results of this RHP analysis clearly show that the most important region in the state is the Gran Sierra Plegada, occupying rank 1 for endemic species and rank 2 for high vulnerability species. This finding is interesting, given the small amount of this physiographic region situated in Coahuila (2,178 km², as noted above),

Table 16. Number of herpetofaunal species in the three EVS categories among the 10 physiographic regions of Coahuila, Mexico. Rank determined by the relative number of high EVS species. Non-native species are excluded.

Physiographic Province	Low	Medium	High	Total	Rank Order
Bolsón de Mapimi	16	15	12	43	5
Llanuras y Sierras Volcánicas	18	16	9	43	6
Laguna de Mayrán	16	14	7	37	7
Sierras y Llanuras Coahuilenses	28	38	22	88	1
Serranía del Burro	19	16	9	44	6
Sierra de la Paila	17	15	7	39	7
Pliegues Saltillo Parras	17	17	13	47	4
Sierras Transversales	14	18	14	46	3
Gran Sierra Plegada	16	17	17	50	2
Llanuras de Coahuila y Nuevo León	16	27	7	50	7



No. 17. *Rhinocheilus lecontei* Baird and Girard, 1853. The Long-nosed Snake occurs from “California to Kansas, excluding much of the Great Basin and the Rocky Mountains, southward to Baja California and Nayarit and, east of the Sierra Madre [Occidental], to the southern limited of the Chihuahua Desert” (Lemos-Espinal et al. 2015: 371). This individual was located at ca. 4 km east of Nava, in the municipality of Nava. Wilson et al. (2013a) assessed its EVS as 8, placing it in the upper portion of the low vulnerability category. Its conservation status is judged as Least Concern by IUCN, but it is not listed by SEMARNAT. *Photo by Marco Antonio Bazán-Tellez.*



No. 18. *Tantilla atriceps* (Günther, 1895). The Mexican Black-headed Snake is distributed from “extreme southern Texas southward through central Coahuila to extreme northeastern Durango and northern Tamaulipas and San Luis Potosí” (Lemos-Espinal et al. 2015: 382). This individual came from Rancho La Boca, on the border of the municipalities of Bustamante and Mina. Wilson et al. (2013a) calculated its EVS as 11, placing it in the lower portion of the medium vulnerability category. Its conservation status has been considered as Least Concern by IUCN, and as a threatened species (A) by SEMARNAT. *Photo by Michael S. Price.*



No. 19. *Micrurus tener* (Baird and Girard, 1853). The Texas Coralsnake occurs “from the Mississippi River westward into Texas, in the United States, and in Mexico, from Tamaulipas south to Veracruz...” (Lemos-Espinal and Dixon 2013: 240). This individual came from ca. 16 km east of Nava, in the municipality of Nava. Wilson et al. (2013a) calculated its EVS as 11, placing it in the middle of the medium vulnerability category. Its conservation status has been determined as Least Concern by IUCN, and this species is not listed by SEMARNAT. *Photo by Marco Antonio Bazán-Tellez.*



No. 20. *Crotalus atrox* Baird and Girard, 1853. The Western Diamondback Rattlesnake occupies “much of the southwestern USA south to northeastern Baja California, Sonora and northern Sinaloa, and east of the Sierra Madre Occidental from Chihuahua east to Tamaulipas and south to Hidalgo and Veracruz” (Rorabaugh and Lemos-Espinal 2016: 573). This individual was found at ca. 1 km NW from Ejido Mieleras, in the municipality of Viesca. Wilson et al. (2013a) determined its EVS as 9, placing it at the upper limit of the low vulnerability category. Its conservation status is judged as Least Concern by IUCN and as a species of special protection (Pr) by SEMARNAT. *Photo by Marco Antonio Bazán-Tellez.*

although it has considerably more area outside the state. The two other regions indicated above (Sierras Transversales and Sierras y Llanuras Coahuilenses) are considerably larger. The Gran Sierra Plegada supports 18 country endemics (Table 15) and 17 high vulnerability species (Table 16). The Sierras Transversales contains 13 country endemics (Table 15) and 14 high vulnerability species (Table 16); the respective figures for the Sierras y Llanuras Coahuilenses are eight endemic species and 22 high vulnerability species. The level of protection provided for these various species is indicated in the following section on protected areas.

Protected Areas in Coahuila

A system of formally protected areas is integral to any effort to protect any portion of the planetary biota from the principal anthropogenic impacts brought about by habitat degradation and destruction. Ostensibly, such a system should incorporate as much of the environmental diversity that exists within the target region (in this case, the state of Coahuila) and as large of a portion of that patrimony as is feasible within existing economic confines. In an effort to determine how these concerns have been addressed in Coahuila, information on the protected areas in the state has been collated and presented in Table 17.

The data in Table 17 indicate that of the 19 protected areas listed, eight are federal reserves, four are federal/private reserves, three are state reserves, three are state/private reserves, and one is a municipal reserve. The eight areas administered at the federal level include one biosphere reserve, one national park, three floral and faunal protection areas, two resource protection areas, and one national monument.

These 19 areas in Coahuila have been established over the 100 years from 1915 to 2015. Thirteen of these 19 areas have been in existence only since the turn of the century or thereafter, while three were established in the decade of the 1990s, two in the decade of the 1940s, and one in 1915. Thus, it remains to be seen in the analysis of the remainder of the data in Table 17 exactly what has been accomplished in these areas, especially since 68.4% of them (13/19) have existed for fewer than 17 years.

The areas of coverage of these protected areas range broadly from as low as 38 ha to as high as 1,519,385 ha. Interestingly, the largest of the 19 areas is the Área de Protección de Recursos Naturales Cuenca Alimentadora del Distrito Nacional de Riego 04 Don Martín, established in 1915, which is the one with the longest existence. The total coverage of these areas is 2,717,443 ha or approximately 27,174 km², which is 17.9% of the area of Coahuila. Portions of these 19 areas are located in 23 of the 38 municipalities (60.5%).

This system of protected areas in the state contains representatives of eight of the ten physiographic regions, including the Bolsón de Mapimí (one of 20 areas),

Llanuras y Sierras Volcánicas (two), Laguna de Mayrán (one), Sierras y Llanuras Coahuilenses (eight), Serranías del Burro (two), Sierra Transversales (four), Gran Sierra Plegada (four), and Llanuras de Coahuila y Nuevo León (two). The two regions with no representation are the Sierra de la Paila and the Pliegues Saltillo Parras. It is no doubt fortuitous that the three physiographic regions with the greatest amount of representation in the protected areas system are the regions having the great herpetofaunal significance, i.e., the Gran Sierra Plegada, Sierras Transversales, and Sierras y Llanuras Coahuilenses. Unfortunately, however, of the protected areas for which such information is available, all are known to be occupied to some extent by landowners.

Management plans are known to be available for only five of the federal protected areas, which points out the great need for completion of such plans for the remainder of the areas. Even less well represented are herpetofaunal surveys, of which there are only three completed and three in the process of completion. Completion of the remainder of the surveys needs to be undertaken as soon as possible.

In general, systems of protected areas are established without consideration of the conservation needs of the herpetofauna, so it is not surprising that this need is still outstanding in Coahuila. The good news is that the physiographic regions that are herpetofaunally most important, based on our RHP analyses, are those best supplied with protected areas. The bad news is that sizable proportions of those areas are occupied by landowners, have no management plans designed, and have been subject to no herpetofaunal surveys. Thus, at present, there is no chance of answering any of the more pressing questions about the state of population sustainability of the component species of Coahuila's herpetofauna. So, redressing these inadequacies in the design and implementation of the protected areas system has to be undertaken so that the ability of the current system of protected areas to provide for perpetual protection of the state's herpetofauna can be assessed and strengthened.

Here, the expected herpetofaunal content of the 19 protected areas in Coahuila is catalogued by compiling the species known to occupy the physiographic regions represented in each of these regions. We employed this means since too few herpetofaunal surveys have been undertaken in these areas to date. Thus, ground-based field surveys will be necessary to provide the empirical data required to substantiate the actual herpetofaunal content of the state's protected areas. Using this approach, the results are shown in Table 18, and summarized in Table 19.

Of the 143 species recorded in Coahuila, 120 (83.9%) are expected to be found in one or more of the 19 protected areas (Table 19). The number of species expected to occur in each area ranges from three in the Parque Estatal Bosque Urbano Ejército Mexicano to 84 in the Área de Protección de Flora y Fauna Cuatro Ciénegas.

Table 17. Characteristics of the Natural Protected Areas (ANPs) in Coahuila, Mexico. Abbreviations for the facilities in the ANPs are as follows: A = administrative services; R = park guards; S = systems of pathways; and V = facilities for visitors. Information in part from: <http://www.sema.gob.mx/SRN-CONSER-ANP-LISTADO.html>; <http://www.conanp.gob.mx/movil/programas.php>; http://sig.conanp.gob.mx/website/pagsig/anps_decretadas/lista_anps.pdf; <https://www.gob.mx/conanp/acciones-y-programas/areas-destinadas-voluntariamente-a-la-conservacion>; accessed 6 December 2017.

Name	Category	Date of decree	Area (ha)	Municipality	Jurisdiction	Physiographic Region	Facilities Available	Occupied by Landowners	Herpetofaunal Survey Completed	Management Plan Available
Río Bravo del Norte	Monumento Natural	21 Oct 2009	2,175	Acuña, Ocampo	Federal	SLC, SDB	A, R	Yes	No	Yes
Maderas del Carmen	Área de Protección de Flora y Fauna	07 Nov 1994	208,381	Acuña, Múzquiz, Ocampo	Federal	SLC	A, R	Yes	In process	Yes
Ocampo	Área de Protección de Flora y Fauna	05 Jun 2009	344,238	Ocampo	Federal	SLC	A, R	Yes	No	Yes
Cuatro Ciénegas	Área de Protección de Flora y Fauna	07 Nov 1994	84,347	Cuatro Ciénegas	Federal	SLC	A, R, S, V	Yes	Yes	Yes
Mapimí	Reserva de la Biósfera	27 Nov 2000	86,606	Francisco I. Madero, Sierra Mojada	Federal	BDM		Yes	Yes	Yes
Los Novillos	Parque Nacional	18 Jun 1940	38	Acuña	Federal	LCN	A, R, S, V	Yes	No	No
Cuenca Alimentadora del Distrito Nacional de Riego 04 Don Martín	Área de Protección de Recursos Naturales	16 May 1915	1,519,385	Acuña, Candela, Castaños, Cuatro Ciénegas, Lamadrid, Juárez, Monclova, Múzquiz, Nadores, Ocampo, Sabinas, Sacramento, San Buenaventura, San Juan de Sabinas, Zaragoza	Federal	SLC, SDB, LCN	A, R	Yes	No	No
Distrito Nacional de Riego 026 Bajo Río San Juan.	Área de Protección de Recursos Naturales	03 Aug 1949 (07 Nov 2002)	197,157 (combined total in Coahuila and Nuevo León)	Arteaga, Ramos Arizpe	Federal	GSP		Yes	No	No
Rancho Media Luna	Área Destinada Voluntariamente a la Conservación	2005	17,181	Ocampo	Federal/Private	SLC, LSV	N.A.	N.A.	N.A.	N.A.
Rancho La Puerta	Área Destinada Voluntariamente a la Conservación	2015	1,443	Saltillo	Federal/Private	GSP	N.A.	N.A.	N.A.	N.A.

Table 17 (continued). Characteristics of the Natural Protected Areas (ANPs) in Coahuila, Mexico. Abbreviations for the facilities in the ANPs are as follows: A = administrative services; R = park guards; S = systems of pathways; and V = facilities for visitors. Information in part from: <http://www.sema.gob.mx/SRN-CONSER-ANP-LISTADO.html>; <http://www.conanp.gob.mx/movil/programas.php>; http://sig.conanp.gob.mx/website/pagsig/anps_decretadas/lista_anps.pdf; <https://www.gob.mx/conanp/acciones-y-programas/areas-destinadas-voluntariamente-a-la-conservacion>; accessed 6 December 2017.

Name	Category	Date of decree	Area (ha)	Municipality	Jurisdiction	Physiographic Region	Facilities Available	Occupied by Landowners	Herpetofaunal Survey Completed	Management Plan Available
Tierra Silvestre Cañón del Diablo	Área Destinada Voluntariamente a la Conservación	2009	22,378	Acuña	Federal/Private	SLC	N.A.	N.A.	N.A.	N.A.
Sierra San Vicente	Área Destinada Voluntariamente a la Conservación	2007	15,247	Ocampo	Federal/Private	SLC, LSV	N.A.	N.A.	N.A.	N.A.
Sierra de Zapalinamé	Zona Sujeta a Conservación Ecológica	15 Oct 1996(1ª) 4 Feb 1997 (2ª)	25,680	Arteaga, Saltillo,	State	GSP	N.A.	N.A.	In process	N.A.
Zapalinamé	Zona de Restauración	08 Jun 2007	1,827 (1,707.75)	Arteaga, Saltillo, Arteaga	State	GSP	N.A.	N.A.	In process	N.A.
Bosque Urbano Ejército Mexicano	Parque Estatal	22 Nov 2013	51	Saltillo	State	STR	N.A.	N.A.	No	N.A.
El “Tulillo”	Área Destinada a la Preservación de los Ecosistemas y su Biodiversidad de Iniciativa Voluntaria	26 Nov 2013	66	General Cepeda	State/Private	STR	N.A.	N.A.	No	N.A.
Villa Bilbao	Área Destinada a la Preservación de los Ecosistemas y su Biodiversidad de Iniciativa Voluntaria	17 Jun 2014	21,001	Viesca	State/Private	LDM	N.A.	N.A.	No	N.A.
Tomás Garrido	Área Destinada a la Preservación de los Ecosistemas y su Biodiversidad de Iniciativa Voluntaria	17 Jun 2014	16,206	Viesca	State/Private	STR	N.A.	N.A.	No	N.A.
Sierra y Cañón de Jimulco	Zona Natural Protegida	27 Jun 2003	48,649	Torreón	Municipal	STR	N.A.	N.A.	Yes	N.A.

Table 18. Distribution of herpetofaunal species in Natural Protected Areas of Coahuila, Mexico, based on estimated inclusions. Abbreviations are as follows: * = species endemic to Mexico; ** = species endemic to Coahuila; and *** = non-native species.

Taxa	Natural Protected Area																		
	Río Bravo del Norte	Maderas del Carmen	Ocampo	Cuatro Ciénegas	Mapimí	Los Novillos	Don Martín	Bajo Río San Juan.	Rancho Media Luna	Rancho La Puerta	Cañón del Diablo	Sierra San Vicente	Sierra de Zapalinamé	Zapalinamé	BU Ejército Mexicano	El “Tulillo”	Villa Bilbao	Tomás Garrido	Sierra y Cañón de Jimulco
Anura (16 species)																			
Bufonidae (7 species)																			
Anaxyrus cognatus	+	+	+	+	+		+		+		+	+					+		
Anaxyrus debilis	+	+	+	+	+	+	+	+	+	+	+	+	+	+		+	+	+	+
Anaxyrus punctatus	+	+	+	+	+	+	+	+	+	+	+	+	+	+		+	+	+	+
Anaxyrus speciosus	+	+	+	+		+	+		+		+	+							
Anaxyrus woodhousii					+														
Incilius nebulifer	+	+	+	+		+	+		+		+	+							
Rhinella horribilis	+	+	+	+		+	+		+		+	+							
Craugastoridae (1 species)																			
Craugastor augusti				+															
Eleutherodactylidae (2 species)																			
Eleutherodactylus cysthignathoides						+	+												
Eleutherodactylus guttilatus	+	+	+	+			+		+		+	+							
Hylidae (1 species)																			
Dryophytes arenicolor	+	+	+	+					+		+	+							
Microhylidae (1 species)																			
Gastrophryne olivacea	+	+	+	+	+	+	+	+	+	+	+	+	+	+			+		
Ranidae (2 species)																			
Lithobates berlandieri	+	+	+	+	+	+	+	+	+	+	+	+	+	+		+	+	+	+
Lithobates catesbeianus***	+	+																	
Scaphiopodidae (2 species)																			
Scaphiopus couchii	+	+	+	+	+	+	+	+	+	+	+	+				+	+	+	+
Spea multiplicata	+	+	+	+	+	+	+	+	+	+	+	+	+	+		+	+	+	+
Squamata (93 species)																			
Anguidae (4 species)																			
Gerrhonotus infernalis	+	+	+	+	+		+	+	+	+	+	+	+	+		+	+	+	+
Gerrhonotus lugoi**				+															
Gerrhonotus mccoysi**				+															
Gerrhonotus parvus*													+	+					
Crotaphytidae (4 species)																			
Crotaphytus antiquus**																	+		

The herpetofauna of Coahuila, Mexico

Table 18 (continued). Distribution of herpetofaunal species in Natural Protected Areas of Coahuila, Mexico, based on estimated inclusions. Abbreviations are as follows: * = species endemic to Mexico; ** = species endemic to Coahuila; and *** = non-native species.

Taxa	Natural Protected Area														
	Río Bravo del Norte	Maderas del Carmen	Ocampo	Cuatro Ciénegas	Mapimi	Los Novillos	Don Martín	Bajo Río San Juan.	Rancho Media Luna	Rancho La Puerta	Cañón del Diablo	Sierra San Vicente	Sierra de Zapalinamé	Zapalinamé	BU Ejército Mexicano
<i>Crotaphytus reticulatus</i>							+								
<i>Gambelia wislizenii</i>	+	+	+	+			+		+		+	+			
Eublepharidae (2 species)															
<i>Coleonyx brevis</i>	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Coleonyx reticulatus</i>		+		+											
Gekkonidae (1 species)															
<i>Hemidactylus turcicus</i> ***	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Phrynosomatidae (22 species)															
<i>Cophosaurus texanus</i>	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Holbrookia approximans</i> *			+	+	+										+
<i>Phrynosoma cornutum</i>	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Phrynosoma modestum</i>	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Sceloporus cantus</i> *															+
<i>Sceloporus couchii</i> *			+	+											+
<i>Sceloporus cowlesi</i>	+	+	+	+	+		+	+	+	+	+	+	+	+	+
<i>Sceloporus cyanogenys</i>	+						+								
<i>Sceloporus grammicus</i>	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Sceloporus maculosus</i> *					+										
<i>Sceloporus magister</i>	+	+	+	+			+		+		+	+			
<i>Sceloporus merriami</i>	+	+	+	+			+		+		+	+			+
<i>Sceloporus olivaceus</i>	+	+	+	+		+	+		+		+	+			
<i>Sceloporus ornatus</i> *													+	+	
<i>Sceloporus parvus</i> *													+	+	
<i>Sceloporus poinsetti</i>	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Sceloporus samcolemanni</i> *															+
<i>Sceloporus spinosus</i> *													+	+	
<i>Uma exsul</i> **					+										
<i>Uma paraphygas</i> *					+										
<i>Urosaurus ornatus</i>	+	+													
<i>Uta stansburiana</i>		+	+	+	+		+		+	+	+	+		+	+
Scincidae (3 species)															
<i>Plestiodon dicei</i> *								+							
<i>Plestiodon obsoletus</i>	+	+	+	+	+	+	+		+		+	+		+	+
<i>Plestiodon tetragrammus</i>	+	+	+	+		+	+		+		+	+			
Sphenomorphidae (2 species)															

Table 18 (continued). Distribution of herpetofaunal species in Natural Protected Areas of Coahuila, Mexico, based on estimated inclusions. Abbreviations are as follows: * = species endemic to Mexico; ** = species endemic to Coahuila; and *** = non-native species.

Taxa	Natural Protected Area														
	Río Bravo del Norte	Maderas del Carmen	Ocampo	Cuatro Ciénegas	Mapimí	Los Novillos	Don Martín	Bajo Río San Juan.	Rancho Media Luna	Rancho La Puerta	Cañón del Diablo	Sierra San Vicente	Sierra de Zapalinamé	Zapalinamé	BU Ejército Mexicano
<i>Scincella lateralis</i>		+													
Teiidae (4 species)															
<i>Aspidoscelis gularis</i>	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Aspidoscelis inornata</i>		+	+	+	+		+	+	+	+	+	+	+		+
<i>Aspidoscelis marmorata</i>	+	+	+	+	+		+		+		+	+			+
<i>Aspidoscelis tessellata</i>	+	+	+	+			+		+		+	+			
Xantusiidae (1 species)															
<i>Xantusia extorris</i> *					+										
Colubridae (26 species)															
<i>Arizona elegans</i>	+	+	+	+	+	+	+		+		+	+			+
<i>Bogertophis subocularis</i>	+	+	+	+	+		+		+		+	+			+
<i>Coluber constrictor</i>	+	+	+	+			+		+		+	+			
<i>Drymarchon melanurus</i>	+	+	+	+		+	+		+		+	+			
<i>Gyalopion canum</i>	+	+	+	+		+	+		+		+	+			
<i>Lampropeltis alterna</i>	+	+	+	+			+		+		+	+			
<i>Lampropeltis annulata</i>	+	+	+	+		+	+		+		+	+			
<i>Lampropeltis leonis</i> *								+					+	+	
<i>Lampropeltis splendida</i>	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Masticophis flagellum</i>	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Masticophis schotti</i>						+	+								
<i>Masticophis taeniatus</i>	+	+	+	+	+		+		+		+	+			+
<i>Opheodrys aestivus</i>	+	+	+	+			+		+		+	+			
<i>Pantherophis bairdi</i>	+	+	+	+			+		+		+	+			
<i>Pantherophis emoryi</i>	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Pituophis catenifer</i>	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Pituophis deppei</i> *								+		+			+	+	+
<i>Rhinocheilus lecontei</i>	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Salvadora deserticola</i>	+	+	+	+			+		+		+	+			
<i>Salvadora grahamiae</i>	+	+	+	+			+		+		+	+			
<i>Sonora episcopa</i>	+	+	+	+	+	+	+		+		+	+			+
<i>Tantilla atriceps</i>	+	+	+	+			+		+		+	+			
<i>Tantilla gracilis</i>						+	+								
<i>Tantilla hobartsmithi</i>	+	+	+	+			+		+		+	+			
<i>Tantilla nigriceps</i>						+	+								

The herpetofauna of Coahuila, Mexico

Table 18 (continued). Distribution of herpetofaunal species in Natural Protected Areas of Coahuila, Mexico, based on estimated inclusions. Abbreviations are as follows: * = species endemic to Mexico; ** = species endemic to Coahuila; and *** = non-native species.

Taxa	Natural Protected Area														
	Río Bravo del Norte	Maderas del Carmen	Ocampo	Cuatro Ciénegas	Mapimí	Los Novillos	Don Martín	Bajo Río San Juan.	Rancho Media Luna	Rancho La Puerta	Cañón del Diablo	Sierra San Vicente	Sierra de Zapalín	Zapalín	BU Ejército Mexicano
Dipsadidae (4 species)															
Diadophis punctatus	+	+	+	+			+		+		+	+			
Heterodon kennerlyi	+	+	+	+	+	+	+		+		+	+			+
Hypsiglena jani	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Leptodeira septentrionalis	+	+	+	+			+		+		+	+			
Elapidae (1 species)															
Micrurus tener	+	+	+	+		+	+	+	+	+	+	+	+	+	
Leptotyphlopidae (3 species)															
Rena dissecta	+	+	+	+			+		+		+	+			
Rena dulcis	+	+	+	+		+	+		+		+	+			
Rena segrega	+	+	+	+			+		+		+	+			
Natricidae (7 species)															
Nerodia erythrogaster	+	+	+	+		+	+		+		+	+			
Nerodia rhombifer						+	+								
Storeria hidalgoensis*								+		+			+	+	
Thamnophis cyrtopsis	+	+	+	+			+		+		+	+			
Thamnophis exsul*								+		+			+	+	
Thamnophis marcianus	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Thamnophis proximus	+	+	+	+		+	+		+		+	+			
Viperidae (9 species)															
Agkistrodon contortrix	+	+	+	+			+		+		+	+			
Crotalus atrox	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Crotalus lepidus	+	+	+	+			+	+	+	+	+	+	+	+	
Crotalus molossus								+		+			+	+	+
Crotalus morulus*								+		+			+	+	
Crotalus ornatus	+	+	+	+			+		+		+	+			
Crotalus pricei								+		+			+	+	
Crotalus scutulatus	+	+	+	+	+										+
Sistrurus tergeminus				+											
Testudines (11 species)															
Emydidae (5 species)															
Pseudemys gorzugi	+						+								
Terrapene coahuila**				+											
Trachemys gaigeae		+													
Trachemys scripta***	+	+					+								

Table 18 (continued). Distribution of herpetofaunal species in Natural Protected Areas of Coahuila, Mexico, based on estimated inclusions. Abbreviations are as follows: * = species endemic to Mexico; ** = species endemic to Coahuila; and *** = non-native species.

Taxa	Natural Protected Area																		
	Río Bravo del Norte	Maderas del Carmen	Ocampo	Cuatro Ciénegas	Mapimí	Los Novillos	Don Martín	Bajo Río San Juan.	Rancho Media Luna	Rancho La Puerta	Cañón del Diablo	Sierra San Vicente	Sierra de Zapalín	Zapalín	BU Ejército Mexicano	El “Tulillo”	Villa Bilbao	Tomás Garrido	Sierra y Cañón de Jimulco
Kinosternidae (2 species)																			
<i>Kinosternon durangoense</i> *					+														
<i>Kinosternon flavescens</i>	+	+	+	+		+	+		+		+								
Testudinidae (2 species)																			
<i>Gopherus berlandieri</i>	+	+	+	+		+	+		+		+	+							
<i>Gopherus flavomarginatus</i> *					+														
Trionychidae (2 species)																			
<i>Apalone atra</i> **				+															
<i>Apalone spinifera</i>	+	+	+	+			+		+		+	+							
Totals	76	79	75	84	44	46	80	36	72	35	72	71	39	39	3	36	37	36	38

Of the 120 species included in Table 18, 26 (21.0%) are endemic species, including seven (5.8%) state endemics (*Gerrhonotus mccoysi*, *Crotaphytus antiquus*, *Uma exsul*, *Scincella kikaapoa*, *Terrapene coahuila*, *Trachemys taylori*, and *Apalone atra*). Ninety-one of the 120 species (75.8%) are non-endemics, and three (2.5%) are non-natives (all of the three that occur in the state). Naturally, it is not desirable to have the non-native species within protected areas, but, fortunately, only one of the three (*Hemidactylus turcicus*) is expected to be found in more than three of the areas (and it is expected in all of them).

Of the 23 species that are not expected to be found within the 19 existing protected areas, 12 are country endemics:

- Eleutherodactylus longipes*
- Rheohyla miotympanum*
- Ambystoma velasci*
- Aquiloerycea galeanae*
- Aquiloerycea scandens*
- Chiropterotriton priscus*
- Barisia imbricata*
- Phrynosoma orbiculare*
- Sceloporus cyanostictus*
- Sceloporus goldmani*
- Sceloporus minor*
- Scincella silvicola*

One of the 23 species (*Sceloporus gadsdeni*) is a state endemic and 10 are non-endemics (*Acris blanchardi*, *Smilisca baudinii*, *Holbrookia lacerata*, *Sceloporus*

marmoratus, *Lampropeltis gentilis*, *Tantilla cucullata*, *Trimorphodon wilkinsonii*, *Crotalus viridis*, *Terrapene ornata*, and *Kinosternon hirtipes*).

The principal herpetofaunal conservation goal for Coahuila, at this point, is to conduct herpetofaunal surveys in all currently-established conservation areas to determine which species are now actually represented. Based on this analysis, we predict that relatively few species are expected to be absent from all of these 19 areas, so a subsidiary goal is to ascertain whether this is the case and, if so, what other areas could be established to contain them.

Conclusions and Recommendations

Conclusions

- A. At the present time, the herpetofauna of Coahuila comprises 143 species, including 20 anurans, four salamanders, 106 squamates, and 13 turtles; three species are non-natives.
- B. The number of herpetofaunal species distributed among the 10 physiographic regions we recognize in Coahuila varies from 38 in the Laguna de Mayrán region to 91 in the Sierras y Llanuras Coahuilenses.
- C. The level of endemism of the herpetofauna of Coahuila is relatively low. Of the 143 species recorded from the state, 40 are endemic to Mexico, including nine limited to Coahuila. Thus, the percentage of endemism

Table 19. Summary of the distributional status of herpetofaunal species in protected areas in Coahuila, Mexico. Totals = total number of species recorded in all of the listed protected areas.

Protected Areas	Number of Species	Distributional Status			
		Non-endemic (NE)	Country Endemic (CE)	State Endemic (SE)	Non-native (NN)
Río Bravo del Norte	76	73	—	—	3
Maderas del Carmen	79	76	—	—	3
Ocampo	75	72	2	—	1
Cuatro Ciénegas	84	75	3	5	1
Mapimí	44	36	6	1	1
Los Novillos	46	45	—	—	1
Cuenca Alimentadora del Distrito Nacional de Riego 04 Don Martín	80	78	—	—	2
Distrito Nacional de Riego 026 Bajo Río San Juan.	36	30	5	—	1
Rancho Media Luna	72	71	—	—	1
Rancho La Puerta	35	31	3	—	1
Tierra Silvestre Cañón del Diablo	72	71	—	—	1
Sierra San Vicente	71	70	—	—	1
Sierra de Zapalinamé	39	30	8	—	1
Zapalinamé	39	30	8	—	1
Bosque Urbano Ejército Mexicano	3	2	—	—	1
El “Tulillo”	36	32	3	—	1
Villa Bilbao	37	35	—	1	1
Tomás Garrido	36	32	3	1	—
Sierra y Cañón de Jimulco	38	32	5	—	1
Totals	120	91	19	7	3

is 28.6%. The 40 endemic species amount to 4.9% of the 811 endemic species in Mexico.

D. The distributional status of the Coahuilan herpetofauna is as follows (in order of the size of the categories): non-endemics (100, 69.9%); country endemics (31, 21.7%); state endemics (nine, 6.3%); and non-natives (three, 2.1%).

E. The principal environmental threats in Coahuila are urban development, industrial pollution, deforestation for agricultural and ranching purposes, road effects, mining and energy projects, natural gas fracking, wind turbines, elimination due to cultural beliefs and practices, collecting and commercial trade, and forest fires.

F. The SEMARNAT, IUCN, and EVS systems were used to evaluate the conservation status of the herpetofauna of Coahuila. As demonstrated in previous MCS studies, the SEMARNAT system proved to be of little value, inasmuch as only 35.7% of the native herpetofauna has been evaluated to date. Of these 50 species, four are placed in the endangered category (P), 23 in the threatened category (A), and 23 in the special protection category (Pr).

G. The IUCN system was also applied to assess the native Coahuilan herpetofauna, and the results (by category

and proportion) are: CR (0 of 140 species; 0%); EN (7; 5.0%); VU (7; 5.0%); NT (8; 5.7%); LC (94; 67.1%); DD (1; 0.7%); and NE (23; 16.4%).

H. In addition, the EVS system was applied to the 140 native Coahuilan species. It placed them in the low, medium, and high vulnerability categories, and the values increased from low (33; 23.6%) to medium (55; 39.3%) and then slightly decreased in the high category (52; 37.1%).

I. The IUCN and EVS conservation status allocations ascertained that only 26.9% of the EVS high vulnerability species have been placed in two of the three IUCN threat categories (EN and VU; while no species are allocated to the CR category) and only 35.1% of the EVS low vulnerability species have been placed in the LC category. As such, the results of the application of these two systems do not correspond well to one another.

J. An analysis of the conservation status of the 118 species placed in the IUCN DD, NE, and LC categories demonstrates that many of them have been evaluated inappropriately compared to their respective EVS values. We opine that these species need to be reassessed to better reflect their prospects for survival.

K. The Relative Herpetofaunal Priority (RHP) measure



Fig. 23. *Forest Fires.* The scene after a forest fire in the vicinity of Arteaga, in the municipality of Arteaga. *Photo by Manuel Nevárez de los Reyes.*

was applied to establish the conservation significance of the ten regional herpetofaunas in Coahuila, which indicates that the most significant herpetofauna is that of the Gran Sierra Plegada, as it contains the greatest number of country endemics and the second greatest number of high vulnerability species. The other nine physiographic regions are arranged in decreasing order of significance on the basis of their number of endemic species, as follows: Sierra Transversales; Sierras y Llanuras Coahuilenses; Bolsón de Mapimí; Pliegues Saltillo Parras; Laguna de Mayrán and Sierra de la Paila; Llanuras y Sierras Volcánicas, Serranías del Burro, and Llanuras de Coahuila y Nuevo León. On the basis of their numbers of high vulnerability species, the ranking is as follows: Sierras y Llanuras Coahuilenses; Gran Sierra Plegada; Sierras Transversales; Pliegues Saltillo Parras; Bolsón de Mapimí; Llanuras y Sierras Volcánicas and Serranía del Burro; Laguna de Mayrán, Sierra de la Paila, and Llanuras de Coahuila y Nuevo León.

L. Nineteen protected areas have been established in Coahuila; eight federal reserves, four federal/private reserves, three state reserves, three state/private reserves, and one municipal reserve. The representation of these 19 areas among the ten physiographic areas is weighted in favor of the Sierras y Llanuras Coahuilenses (eight areas), which ranked 3rd in endemic species and 1st in high vulnerability species. The Gran Sierra Plegada is the next best represented (in four areas). Unfortunately, all of the 19 protected areas for which information is available are occupied by landowners. In addition, few areas have the

benefit of herpetofaunal surveys or management plans.

M. Our analyses predict that 120 of 143 total species are expected to be found in the 19 protected areas (83.9%). These 120 species include 91 non-endemics, 19 country endemics, seven state endemics, and three non-natives. The non-native species should not be included in the protected areas system.

N. Future conservation efforts should be directed toward conducting thorough herpetofaunal surveys in all components of the protected areas system, as well as determining what additional areas might be required to provide protection for all of Coahuila's herpetofaunal species.

Recommendations

A. Our principal interest in writing this paper has been to assess the conservation status of the 140 native species presently recorded from the state of Coahuila, and to suggest what steps need to be taken to protect all of these species over the long term. We have undertaken this assessment using the EVS methodology, as we have in the previous entries in the Mexican Conservation Series, which demonstrated that 33 species are allocated to the low vulnerability category, 55 to the medium vulnerability category, and 52 to the high vulnerability category. We also employed the Relative Herpetofaunal Priority methodology to determine which of the physiographic regions in the



No. 21. *Crotalus lepidus* (Kennicott, 1861). The Rock Rattlesnake is distributed “in the United States in southeastern Arizona, southern New Mexico, and western Texas” and “in Mexico... in Sonora, Chihuahua, Durango, Sinaloa, Nayarit, Jalisco, Zacatecas, Aguascalientes, Coahuila, Nuevo León, and San Luis Potosí” (Prival and Porter 2016: 444). This individual came from Jimenez, in the municipality of Jimenez. Wilson et al. (2013a) evaluated its EVS as 12, placing it in the upper portion of the medium vulnerability category. Its conservation status is considered as Least Concern by IUCN and as a species of special protection (Pr) by SEMARNAT. *Photo by Michael S. Price.*



No. 22. *Crotalus pricei* Van Denburgh, 1895. The Twin-spotted Rattlesnake ranges “from southeastern Arizona in the United States (Chiricahua, Huachuca, Pinaleno, Dos Cabezas, and Santa Rita mountains) southward in Mexico through the Sierra Madre Occidental to northeastern Sonora, western Chihuahua, and Durango, and in the Sierra Madre Oriental of southeastern Coahuila, southern Nuevo Leon, southwestern Tamaulipas, and north-central San Luis Potosi, and in Aguascalientes” (Hammerson et al. 2007). This individual was found at Monterreal, in the municipality of Arteaga. Wilson et al. (2013a) assessed its EVS as 14, placing it at the lower limit of the high vulnerability category. Its conservation status is judged as Least Concern by IUCN and as a species of special protection (Pr) by SEMARNAT. *Photo by Elí García Padilla.*



No. 23. *Sistrurus tergeminus* (Say, 1823). The Western Massasauga occurs in the USA (Texas, Oklahoma) and Mexico (central and northeastern Coahuila, southern Nuevo León; possibly in Tamaulipas, northern Chihuahua, and northeastern Sonora). This individual came from 6 km south of La Piedra Parada, in the municipality of Guerrero. The EVS value of this rattlesnake is 13. Its conservation status has not been assessed by IUCN and it is not listed by SEMARNAT. *Photo by Manuel Nevarez de los Reyes.*



No. 24. *Terrapene coahuila* Schmidt and Owens, 1944. The Coahuila Box Turtle is a Mexican endemic species restricted to “the Cuatro Ciénegas Bolson of Coahuila” (Lemos-Espinal et al. 2015: 122). This individual was located at Cuatrociénegas in the municipality of Cuatrociénegas de Carranza. Wilson et al. (2013a) calculated its EVS as 19, placing it in the upper portion of the high vulnerability category. Its conservation status is determined as Endangered by IUCN and as threatened (A) by SEMARNAT. *Photo by Michael S. Price.*



No. 25. *Trachemys taylori* (Legler, 1960). The Cuatro Ciénegas Slider is an endemic Mexican species restricted in distribution to the Cuatro Ciénegas Basin (Lemos-Espinal et al. 2015). This individual came from Cuatrociénegas in the municipality of Cuatrociénegas de Carranza. Wilson et al. (2013a) determined its EVS as 19, placing it in the upper portion of the high vulnerability category. Its conservation status is calculated as Endangered by IUCN, but this species is not listed by SEMARNAT. *Photo by Michael S. Price.*

state support the most significant herpetofaunas based on the relative numbers of country endemics and high vulnerability species. Three such areas were identified: the Gran Sierra Plegada, the Sierras Transversales, and the Sierras y Llanuras Coahuilenses. Fortunately, these three regions support the greatest numbers of protected areas among the 19 that are currently established, four, four, and eight, respectively. The herpetofaunal content of these protected areas, however, is very poorly known; as a result, the major conservation goal with respect to the herpetofauna of Coahuila is to carefully document the species inhabiting the protected areas of the state in order to test the predictions made here about their content and to draw up adequate management plans for their perpetual protection.

B. Thus, it will only be after the species inhabiting the existing protected areas have been identified that additional conservation goals can be addressed. These goals include (1) determining what other protected areas might need to be established to protect the remainder of the herpetofauna not found within the existing areas, (2) monitoring of the health of the populations of species within the protected areas, and (3) assessing the well-being of the ecosystems on which these species depend.

C. It is imperative that this work advance as rapidly as possible, especially given that efforts to protect

the Coahuilan herpetofauna lag behind those of the other Mexican states examined thus far in the Mexican Conservation Series.

“We have come a very long way through the barbaric period in which we still live, and now I believe we have learned enough to adopt a transcendent moral precept concerning the rest of life. It is simple and easy to say: Do no further harm to the biosphere.”—E.O. Wilson (2016)

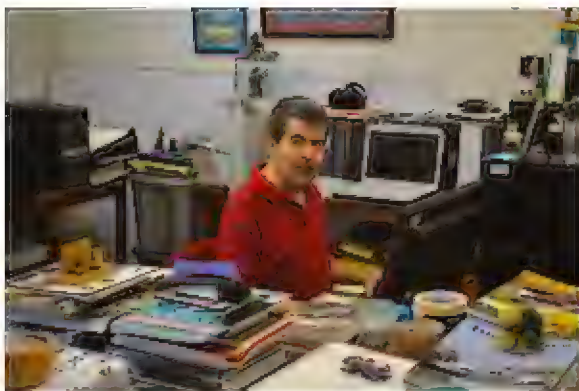
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David Lazcano is a herpetologist who earned a bachelor's degree in chemical science in 1980, and a bachelor's degree in biology in 1982. In 1999, David earned a master's degree in wildlife management, and a doctoral degree in biological sciences with a specialty in wildlife management (2005), all from the Facultad de Ciencias Biológicas of the Universidad Autónoma de Nuevo León (UANL). Currently, he is a full-time professor at the same institution, where he teaches courses in animal behavior, biogeography, biology of chordates, and wildlife management. David is also the head of Laboratorio de Herpetología and Coordinación de Intercambio Académico de la Facultad de Ciencias Biológicas at UANL. Since 1979, he has been teaching and providing assistance in both undergraduate and graduate programs. David's research interests include the herpetofaunal diversity of northeastern Mexico, as well as ecology, herpetology, biology of the chordates, biogeography, animal behavior, and population maintenance techniques of montane herpetofauna.



Manuel Nevárez-de los Reyes is a biologist who graduated from the Universidad Autónoma de Nuevo León (UANL), Facultad de Ciencias Biológicas in San Nicolás de los Garza, México. Manuel's initial interest was in the study of amphibians and reptiles, but his professional life led him to investigate other areas, such as environmental impacts and the study of cacti. From 1997 to 2007, he served as head of Environmental Protection in the Residencia Regional de Construcción Noreste of the Federal Electricity Commission. Manuel has been involved with numerous workshops and conferences, and has authored both popular science and peer-reviewed articles on herpetology and cacti. Among his accomplishments, he discovered and co-authored the original description of a new genus and species of cactus, *Digitostigma caput-medusae*. The following year he created "Proyecto Digitostigma," a nursery dedicated to the commercial propagation of various cacti, which contributes to their knowledge and conservation. Manuel recently obtained his Ph.D. in Wildlife Management and Sustainable Development at the UANL, with a thesis entitled "Ecological distribution of the herpetofauna of the Sierra de Gomas in northern Nuevo León," under a grant from the National Council of Science and Technology. He is now part of the herpetological group that has documented the many herpetological activities in northeastern México (Coahuila, Nuevo León, and Estado de México).



Elí García-Padilla is a herpetologist primarily focused on the ecology and natural history of the Mexican herpetofauna. His research efforts have centered on the Mexican states of Baja California, Tamaulipas, Chiapas, and Oaxaca. His first experience in the field was studying the ecology of the insular endemic populations of the rattlesnakes *Crotalus catalinensis*, *C. muertensis* (*C. pyrrhus*), and *C. tortugensis* (*C. atrox*) in the Gulf of California. Elí's Bachelor's thesis was on the ecology of *C. muertensis* (*C. pyrrhus*) on Isla El Muerto, Baja California, Mexico. To date, he has authored or co-authored over 100 contributions to science. Elí is currently a formal Curator of Amphibians and Reptiles from Mexico in the electronic platform "Naturalista" of the Comisión Nacional para el Uso y Conocimiento de la Biodiversidad (CONABIO-inaturalist; <http://www.naturalista.mx>). One of his main passions is environmental education, and for several years he has worked on various projects that include the use of photography and audiovisual media as a powerful tool for reaching large audiences and promoting the knowledge, protection, and conservation of Mexican biodiversity. Elí's interests include wildlife and conservation photography, and his art has been published in several scientific, artistic, and educational books, magazines, and websites. Presently, he is collaborating on an evaluation of the jaguar (*Panthera onca*) as an umbrella species for the conservation of the herpetofauna of Nuclear Central America.

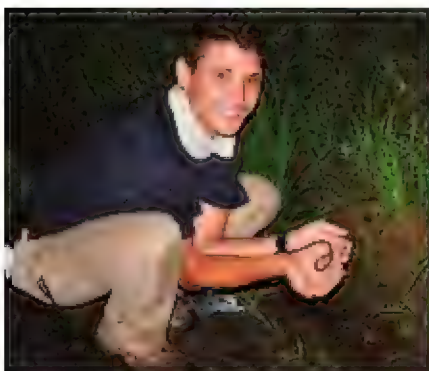


Jerry D. Johnson is Professor of Biological Sciences at The University of Texas at El Paso (UTEP), and has been investigating the systematics, ecology, and conservation of the herpetofauna of Middle America since 1970, especially that of southern Mexico. Jerry is also the Director of UTEP's 40,000-acre Indio Mountains Research Station in the Chihuahuan Desert of Trans-Pecos, Texas. He has authored or co-authored over 120 peer-reviewed papers, and was co-editor or contributor to several major Mesoamerican herpetology books: *Conservation of Mesoamerican Amphibians and Reptiles*, *Mesoamerican Herpetology: Systematics, Zoogeography, and Conservation*, and *Middle American Herpetology: A Bibliographic Checklist*. One species, *Tantilla johnsoni*, was named in his honor. Presently, Jerry is an Associate Editor and Co-chair of the Taxonomic Board of the *Mesoamerican Herpetology* website.

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Vicente Mata-Silva is a herpetologist originally from Río Grande, Oaxaca, Mexico. His interests include ecology, conservation, natural history, and biogeography of the herpetofaunas of Mexico, Central America, and the southwestern United States. Vicente received his B.S. degree from the Universidad Nacional Autónoma de México (UNAM), and his M.S. and Ph.D. degrees from the University of Texas at El Paso (UTEP). Vicente is an Assistant Professor of Biological Sciences at UTEP in the Ecology and Evolutionary Biology Program, and Assistant Director of UTEP's 40,000 acre Indio Mountains Research Station, located in the Chihuahuan Desert of Trans-Pecos, Texas. To date, Vicente has authored or co-authored over 100 peer-reviewed scientific publications. He also was the Distribution Notes Section Editor for the journal *Mesoamerican Herpetology*.



Dominic L. DeSantis is currently a Ph.D. candidate and National Science Foundation Graduate Research Fellow at the University of Texas at El Paso. He received his Bachelor's degree at Texas State University, where he also completed multiple research projects on the antipredator behavior of the critically endangered Barton Springs Salamander (*Eurycea sosorum*). Dominic's ongoing dissertation research integrates multiple field monitoring technologies to study snake movement and behavioral ecology. Dominic accompanied Vicente Mata-Silva, Eli García-Padilla, and Larry David Wilson on survey and collecting trips to Oaxaca in 2015, 2016, and 2017, and he is a co-author on numerous natural history publications produced from those visits.



Larry David Wilson is a herpetologist with lengthy experience in Mesoamerica. He was born in Taylorville, Illinois, USA, and received his university education at the University of Illinois at Champaign-Urbana (B.S. degree) and at Louisiana State University in Baton Rouge (M.S. and Ph.D. degrees). He has authored or co-authored over 410 peer-reviewed papers and books on herpetology. Larry was the senior editor or author of several books, including *Conservation of Mesoamerican Amphibians and Reptiles*, *The Snakes of Honduras*, *Middle American Herpetology*, *The Amphibians of Honduras*, *Amphibians & Reptiles of the Bay Islands and Cayos Cochinos, Honduras*, *The Amphibians and Reptiles of the Honduran Mosquitia*, and *Guide to the Amphibians & Reptiles of Cusuco National Park, Honduras*. To date, he has authored or co-authored the descriptions of 72 currently recognized herpetofaunal species, and seven species have been named in his honor, including the anuran *Craugastor lauraster*, the lizard *Norops wilsoni*, and the snakes *Oxybelis wilsoni*, *Myriopholis wilsoni*, and *Cerrophidion wilsoni*. Larry previously served as an Associate Editor and is presently Co-chair of the Taxonomic Board for the journal *Mesoamerican Herpetology*.